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NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

THESIS

MATRIX ORGANIZATIONAL STRUCTURE AND ITS EFFECT ON ARMY ACQUISTION PROGRAM MANAGEMENT OFFICES

by

Paul Adam Ostrowski

June, 1996

Thesis Advisor: COL (Ret.) David Matthews

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With the implementation of the Defense Management Review, and publications of DoD Directive 5000.1 and DoD 5000.2-R, the Army was mandated to restructure program offices with the intent of cutting waste and fraud within the defense acquisition process. The goal was to establish an organizational structure which could operate efficiently in an environment of shrinking budgets and increasing technical specialization. To address this challenge, the Army followed the aerospace industry's lead, and adopted the matrix management structure. Since its implementation, the matrix structure remains as the management structure of choice within acquisition program offices throughout the Army. While the structure has remained effective, its efficiency remains a point of contention with many program managers. This thesis focuses on evaluating the strengths and weaknesses of the matrix structure within acquisition program offices. In addition, the comments of 18 program managers will be offered regarding some possible methods and organizatinal variants which can be used to improve the matrix structure within acquisition program management offices.

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MATRIX ORGANIZATIONAL STRUCTURE
AND ITS EFFECT ON ARMY ACQUISITION
PROGRAM MANAGEMENT OFFICES

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Submitted in partial fulfillment
of the requirements for the degree of

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ABSTRACT

With the implementation of the Defense Management Review, and publications of DoD Directive 5000.1 and DoD 5000.2-R, the Army was mandated to restructure program offices and operating procedures with the intent of cutting waste and fraud within the defense acquisition process. The goal was to establish an organizational structure which could operate efficiently in an environment of shrinking budgets and increasing technical specialization. To address this challenge, the Army followed the aerospace industry's lead, and adopted the matrix management structure. Since its implementation, the matrix structure remains as the management structure of choice within acquisition program offices throughout the Army. While the structure has remained effective, its efficiency remains a point of contention with many program managers. This thesis focuses on evaluating the strengths and weaknesses of the matrix structure within acquisition program offices. In addition, the comments of 18 program managers will be offered regarding some possible methods and organizational variants which can be used to improve the matrix structure within acquisition program offices.

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I. INTRODUCTION

A. BACKGROUND

The current state of industry, in an ever-progressive and competitive economy, has led to changes in the operating procedures for many high-technology companies. In order for many of these companies to continue to compete amid shrinking budgets and streamlined costs, several began to question the normal operating methods introduced during the Industrial Revolution. Organizational design, once a simple "one-worker, one-boss" concept, has become increasingly difficult to maintain in high-technology organizations which must simultaneously provide specialized services to numerous customers. Industry had to determine the best method of providing efficient and effective relationships between the performances of various technical specialties, while providing for the integration and coordination of these specialties into the organizational effort required on projects and programs. (Davis and Lawrence, 1977, pp. 2-7)

Industry was not alone in its quest for increased integration and coordination of specialties under conditions of shrinking budgets and streamlined costs. Project offices within the U.S. Army responsible for the development and procurement of weapon systems and materials necessary to maintain effective fighting forces into the next century, faced similar challenges. With the implementation of the Defense Management Review, and publication of Department of Defense (DoD) Directive 5000.1 and DoD Instruction 5000.2, the Army was mandated to restructure project offices and operating procedures with the intent of cutting waste and fraud within the defense acquisition process. Inherent

to this process was an internal review of operating procedures in project offices. (Przemienieki, 1993, pp. 53-57)

The results of the Defense Management Review included a streamlined acquisition process designed to cut costs, establish responsibility, and alleviate overlap of systems development between services. In addition, it forced internal reviews designed to correct mismanagement within acquisition program offices (Przemieniecki, 1993, p. 53). No longer would program offices be allowed to escape responsibility for program cost and schedule overruns which were causing financial problems of major proportions. Management structures were established to oversee specified programs and establish responsibility for management. The acquisition "industry" had been forced to enter the same environment as private corporations - one of shrinking budgets, streamlined costs, and specialized services.

Looking toward industry, acquisition executives within the Army sought ideas on how to make the best possible use of available resources while simultaneously cutting operational costs. Faced with requirements for leading-edge technological experts in order to gain success in achieving the myriad of weapon systems requirements, acquisition executives were forced to conduct reviews of their organizational structure. The goal of these reviews was to establish an organizational structure which could operate efficiently in an environment of shrinking budgets and increasing technical specialization. The aerospace industry was among the first to find an innovative solution. The solution was a matrix structure, which attempts to maintain functional specialization while taking

advantage of the improved coordination offered by project management. (Przemieniecki, 1993, pp. 53-57)

With the adoption of the matrix structure by the Army, several weaknesses emerged. These weaknesses continue to plague acquisition program offices today. Until solutions to these weaknesses are found, project managers throughout the Army acquisition "system" will continue to face obstacles which impede, rather than facilitate, effective program management.

B. OBJECTIVES

This thesis has the following objectives:

1. To provide background information on both how matrix organizational structure was developed and the general conditions for its use.

2. To provide information on the various strengths and weaknesses of the matrix structures found in both commercial industry and Army acquisition program offices.

3. To assess current literature, and provide empirical data on methods identified by program managers which either can, or have been, used to alleviate matrix structure weaknesses.

C. RESEARCH QUESTIONS

1. Primary Research Question

What are the possible methods or organizational variants which can be used to improve or optimize the matrix organizational structure as an effective form of management within Army acquisition program management offices?

2. Subsidiary Research Questions

a. What is matrix structure, and when is it used?

b. What are the published benefits and weaknesses of matrix structures?

c. What is DoD's posture on the use of matrix structures?

d. What are the actual benefits and weaknesses of using matrix structure in Army acquisition program offices (based on interviews)?

e. What strategies are available to make matrix structure more effective in Army acquisition program offices?

D. SCOPE

The scope of this thesis is to provide information, analysis, and alternative ways of optimizing matrix structures within Army acquisition program offices. The objective is to propose possible solutions to the matrix weaknesses which generally plague acquisition offices. It is the researcher's intent to look at both possible and established alternative measures which may offer solutions to many of the problems inherent to matrix organizational structures. It is not the intent of the researcher to generate new empirical data or to develop a specific model to test the data. The researcher will assimilate and correlate the literature and data available and highlight possible solutions geared toward optimization.

E. LIMITATIONS

The researcher did not encounter any limitations during the course of gathering the information and writing this thesis. Credit for this is due largely to the excellent support provided by the project managers who were interviewed. The researcher found that their input was candid, professional, and extremely beneficial to the success of this product.

F. ASSUMPTIONS

This thesis was written with the assumptions that:

1. The reader has a need for information on matrix structure within program offices, its advantages, disadvantages, and methods available for its optimization.

2. The reader is in a position to incorporate all or some of the methods available to optimize matrix structure within their organization.

G. METHODOLOGY

The methodology for this thesis entailed a comprehensive literature review and phone interviews with current and former Army acquisition program managers who use(d) a matrix organizational structure within their offices.

A comprehensive literature search and review was conducted in which over 16 articles, books, reports, and theses were reviewed by the researcher. The majority of the literature was provided by academia, Government organizations, commercial organizations, and employees subjected to matrix structures. Although the search was by no means exhaustive of the articles that have been published on matrix structure, the data reviewed provided an adequate sampling and cross-section of what was available. The bibliography contains a listing of the materials reviewed by the researcher.

Telephonic and face-to-face interviews were conducted with 18 current and former Army project managers, as well as Materiel Command managers who have extensive knowledge of how matrix has been adopted for use in project offices. The following offices provided information to this thesis:

1. Army Tactical Missile System (ATACMS)
2. Armored Gun System (AGS)
3. Bradley Fighting Vehicle Systems (BFVS)
4. Bradley Fire Support Vehicle (Bradley Fist)
5. Comanche
6. Joint Surveillance Target Attack Radar System/Ground Station Module (JSTARS/GSM)
7. Air-to-Ground Missiles (AGMS)
8. Army Tactical Missile System-Brilliant Anti-Armor Submunition (ATACMS-BAT)
9. Javelin

10. Multiple Launch Rocket System/Precision Guided Munitions (MLRS/PGM)
11. Family of Medium Tactical Vehicles (FMTV)
12. Joint Tactical Unmanned Aerial Vehicles (JTUAV)
13. Testing Facility, Yuma Proving Grounds
14. Integrated Material Management Center, Missile Command

The following is a sample list of general questions that were asked during the interview:

1. What are the benefits that you receive from the matrix structure in your project office? (examples: cost savings, ability to operate in an environment consisting of scarce resources, ability to hire/fire workers rapidly, etc.) What are the weaknesses?

2. What has driven you to use matrix organizational structure within your project office (TDA determined by PEO policy, level of funding, type of program, Government employee utilization, etc)?

3. What formal and informal feedback methods have you invoked (or could your command invoke) to obtain information on the quality of support provided to you by the materiel commands? Do these systems work? Are there other methods which you would suggest?

4. Within your program's matrix structure, are your matrix support personnel physically co-located at your program office or are they located elsewhere (at the materiel command headquarters), or both? What are your thoughts regarding this situation?

5. Have you experienced the ability to quickly replace or add new matrix personnel support to your program when necessary?

6. Do you feel that current solutions to the rating scheme for matrix personnel (ie, including you, as the PM, into the rating scheme) allow you to influence matrix worker performance and potential for increased responsibility? Do you feel this type of solution should be implemented for awards as well?

7. If given the opportunity, what strategies would you incorporate to make matrix structure more effective in Army acquisition program offices (ie, changes in existing policy, changes in organizational forms, etc)?

H. ORGANIZATION OF THESIS

This thesis is organized around five chapters. Chapter I provides a brief introduction and outlines the objectives and research questions of the thesis. The chapter establishes the framework and ground rules for the thesis in terms of scope, limitations, assumptions, and methodology.

Chapter II introduces the reader to the concept of matrix organizational structure, provides a definition, conditions for use, and concludes with DoD's perspective on the use of matrix structures in Army acquisition program offices. Included in Chapter II is an example of one project office's incorporation of matrix structure: the Army's Tactical Missile System.

Chapter III discusses several published advantages (dual environmental demands, flexible use of specialized personnel, adaptability to external change, and personal skills development) and disadvantages (authority ambiguity, management conflict/power struggles, worker conflict and confusion, communication, and anarchy) of matrix structure. The objective of Chapter III is to introduce the reader to the potential assets and liabilities inherent in matrix structure.

Chapter IV contains data gathered from interviews concerning matrix structure's current strengths and weaknesses as observed in Army acquisition program offices. Additionally, this chapter provides data on how both current and former PMs have successfully alleviated many of the weaknesses found within the matrix organizational structure in order to fully optimize the organizational form. Published methods of

weakness resolution are included as well, in order to provide a more comprehensive source of available information.

Chapter V is a summary of the thesis and answers the primary and subsidiary research questions that were asked in Chapter I. Specific recommendations are offered by the researcher for improving the matrix structure within Army acquisition project offices. Two areas for further research are then identified and discussed. The thesis and the chapter are wrapped up in a final conclusion.

II. BACKGROUND ON MATRIX ORGANIZATIONAL STRUCTURE

A. INTRODUCTION

Like any other ingredient involved in successful business operations, organizational structures are developed in order to provide for a need present in the business environment. Management's ability to choose the right structure, and tailor it to the company's strategic planning and personnel, often determines business success or failure. If management is to succeed, it must carefully pinpoint its company goals and choose an organizational structure which places its people in the best position to achieve them (Meares, 1993, p. 14). Managers in charge of modern business-oriented organizations generally classify organizational structures into one of three basic categories: project, functional, or matrix. While the thrust of this thesis is devoted toward defining and describing the matrix organization, a basic understanding of both functional and project organizations is necessary in order to fully comprehend the complexities associated with matrix organizations.

B. FUNCTIONAL ORGANIZATION

A functional organization is defined as an organization in which individuals with specific technical skills are placed in specialized departments (engineers are placed in an engineering department, personnel experts are placed in a personnel department). This grouping of resources according to a given specialty allows experts to work together in order to provide one particular function or task. (Przemienieki, 1993, pp. 53-57) As shown in Figure 2.1, the functional structure is characterized by an organizational reporting method consisting of direct line authority to progressively higher level managers

in each functional area. The top line functional managers all report to the single general manager, and project work is subdivided and allocated at the lowest possible management level. This allows each functional grouping to work on several projects simultaneously. (Skowrenek, 1976, pp. 5-8)

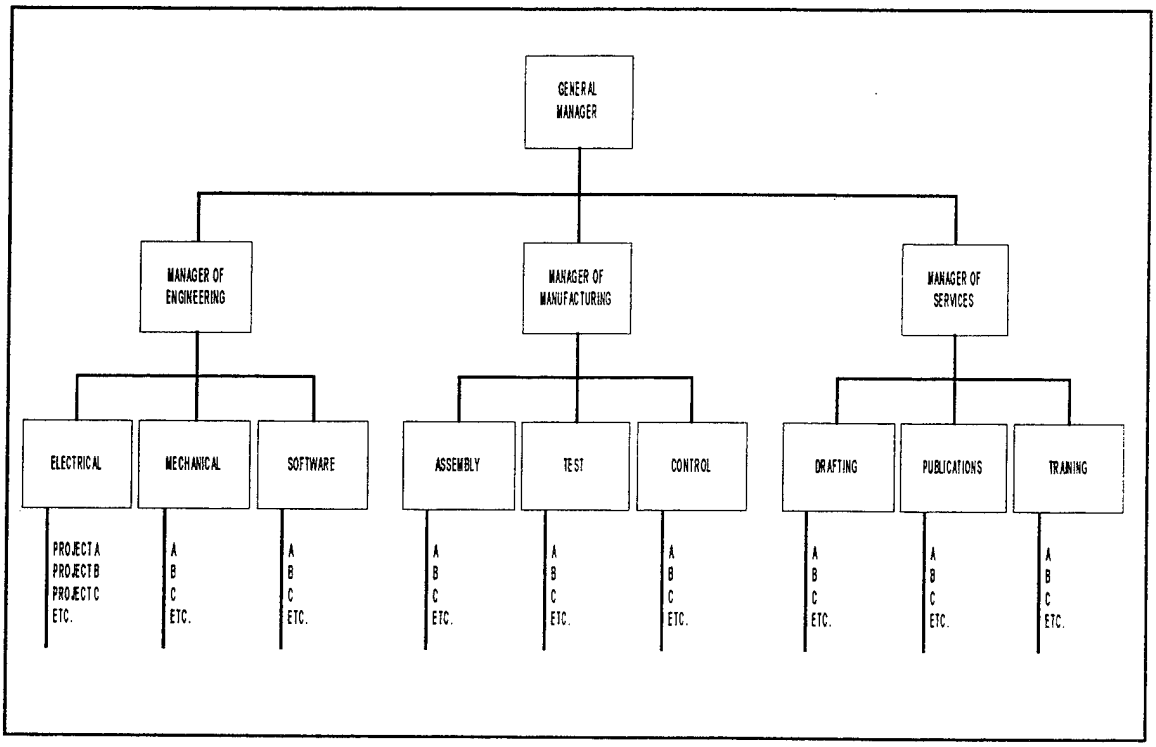

Figure 2.1. Functional Organization (Losi, 1977, p. 6).

The functional structure is a proven type of organizational method for corporations which conduct routine technology and require interdependencies in functional areas. Projects developed under this structure are normally numerous, small, and of relatively short duration (Skowrenek, 1976, p. 8). There are several advantages inherent within the functional structure. First, functional structures offer corporate memory which becomes self-sustaining within each functional base. Failures and lessons learned during earlier projects are accessible to everyone, and ready access to experience is a commonality

shared under this organizational form (Patterson, 1978, p. 9). Another advantage of the functional structure is that it provides the specialized skills and capabilities necessary to deal with sophisticated technology on a small number of products or projects. However, as the number and diversity of projects increases, the ability to complete each task on time, and with appropriate quality, becomes increasingly difficult. (Losi, 1977, p. 5)

Plagued with the inability to respond to project schedules, aerospace corporations, and later their counterparts in Government, began searching for a better form of organization. The goal was to find a structure which was responsive to both accelerated technology and the demands of high priority programs and clients (Patterson, 1978, p. 9). The development of the project structure commenced.

C. PROJECT ORGANIZATION

Project organizations evolved in the 1960's and were used extensively on the nation's space projects. This type of organization is based on the construction of teams consisting of experts from numerous disciplines who are grouped together to complete a single project or program. The goal-oriented foundation of this organizational form enables the project manager to achieve program coordination while responding successfully to program schedules. Armed with an arsenal of experts, the project manager of the team has all the necessary technical and functional area personnel required to take on a project from start to finish, without having to rely on other resources. (Przemienieki, 1993, pp. 53-57) Additionally, the project manager is delegated full responsibility for the development of the project, including authority to plan, coordinate, control, and concentrate any resources required to meet the challenging project needs

(Losi, 1977, p. 3). Figure 2.2 illustrates a typical project organization found in an industrial product division.

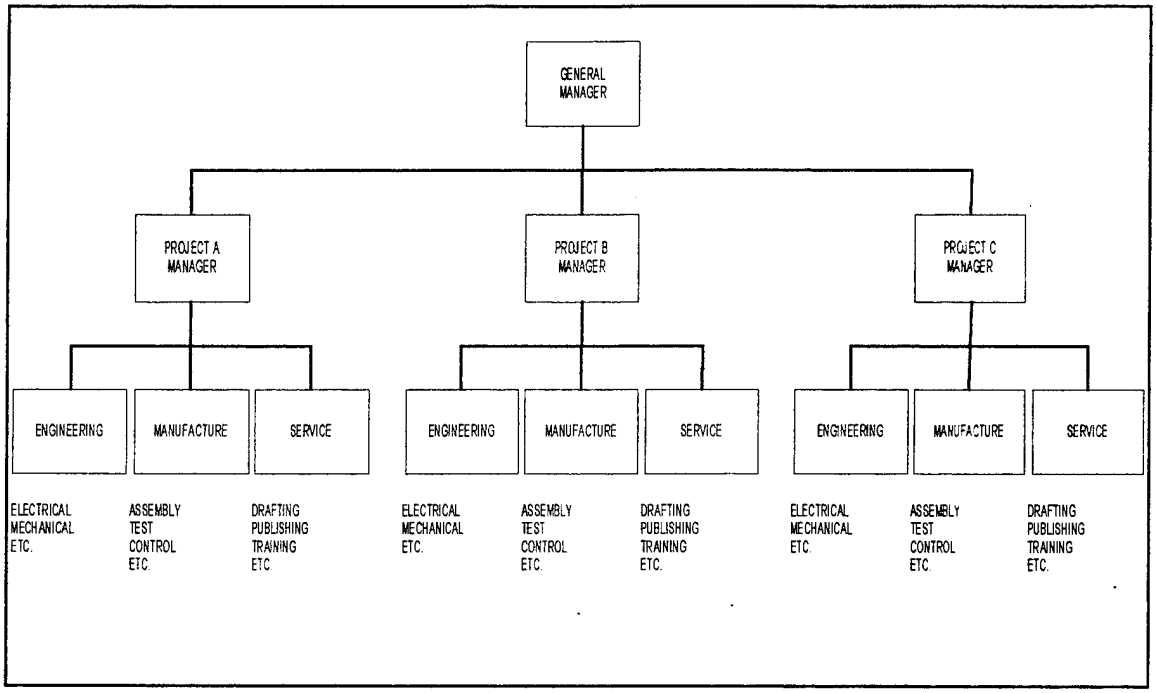

Figure 2.2. Project Organization (Skowronek, 1976, p. 6).

Project organization is often favored by commercial companies for the development of new products, building a factory, or investigating areas that depart from their traditional businesses. Generally, this form of organization is used for one-time undertakings that are infrequent, unique, or unfamiliar to the parent organization. (Skowrenek, 1976, p. 5) While no one will contest the successful use of project organizations during the early space exploration era, project organizations are noted for weaknesses as well. First, project organizations are often very expensive to operate as the costs and resources associated with acquiring and paying core specialists for each

project are tremendous. Next, project structures can affect employee morale. While functional organizations provide a degree of stability, project offices are characterized as short duration, with uncertain futures for project members upon project completion. (Meares, 1993, pp. 14-15) Finally, one weakness inherent in project organizations is the tendency for project managers to retain their best and most experienced people in the project itself. This tendency often stifles opportunities for sharing lessons learned. (Patterson, 1978, p. 10)

It is important to note that in both project and functional organizations, traditional management precepts of unity of command, superior/subordinate lines of authority, and functional division of labor, are preserved by the organizational structure (Losi, 1977, p. 5). This concept changes significantly under the matrix structure.

D. MATRIX ORGANIZATION

Due mainly to the shortcomings of both functional and project organizations, aerospace and defense organizations continued to search for a new organizational structure. The intent of this quest was to develop and establish a stable and long-lasting organization which was capable of implementing the strengths of both the functional and project organizations into a market consisting of uncertain environments, unique technology, and specialized goals. (Patterson, 1978, p. 11) The search led to the matrix organization, which evolved from a combination of both functional and project organizations.

1. What is Matrix Organization?

In their book Matrix, authors Stanley Davis and Paul Lawrence define a matrix organization as any organization that employs a multiple command system that includes not only a multiple command structure, but also related support mechanisms, and an associated organizational culture and behavior pattern. Simply put, it is the process of establishing a totally new organization in which individual workers fall under one manager (department head) while working as part of a concerted effort (defined as a project) under a different manager (project manager). Thus, matrix organizations employ a "two-boss" or multiple command structure as opposed to the conventional "one-boss" system. (Davis and Lawrence, 1977, p. 3) A typical matrix organization is depicted in Figure 2.3.

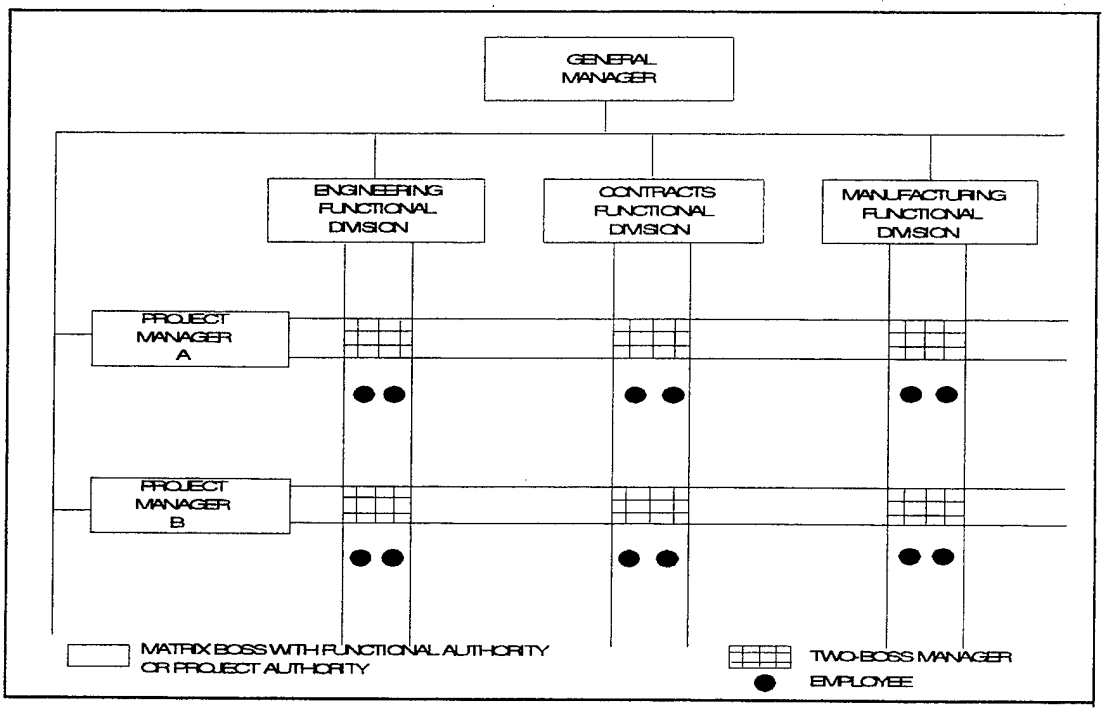

Figure 2.3. Matrix Organization (Przemienieki, 1993, p. 57)

Is the matrix system appropriate for all industry? The answer is no. Matrix organizations are established only when appropriate conditions exist within the industry's service sector. As a rule of thumb, Davis and Lawrence point out three conditions which should exist within an industry for it to consider implementation of a matrix organization. These three conditions are: outside pressure for dual focus, pressure for high information-processing capacity, and pressure for shared resources. (Davis and Lawrence, 1977, pp. 11-17)

2. Conditions for Use

a. Outside pressure for Dual Focus

Conventional organizations have historically focused human energy by grouping people into different organizational units with defined boundaries and common bosses which serviced a small, well-defined set of customers. Additionally, conventional organizations often center around technical specialties (engineering, research and development, manufacturing, logistics, etc.) which enable group members to reinforce each other's technical proficiency. Matrix organizations were developed because there was a unique need to satisfy each of these requirements simultaneously. (Davis and Lawrence, 1977, pp. 11-13) In other words, attention had to focus both on complex technical issues and on the project requirements of the customer. In this case, each requirement is a priority, and neither can overrule the other. Managers were placed in charge of each project and in charge of each section (engineering, research and development) specialty. This dual command structure induces simultaneous decision-making and a balance of power between each manager.

b. Pressure for High Information-Processing Capacity

The second condition which suggests the use of a matrix organization is that the industry's organizational members have a high requirement for information-processing capacity. Under conventional management, the organization establishes procedures and policies for passing communications and information between levels. A hierarchy is established which directs information to the appropriate office. (Davis and Lawrence, 1977, pp. 14-16) However, what happens when the information load is extremely large and complex? Decision-makers become overloaded with input regarding decisions on numerous projects without having full knowledge of any particular one. Matrix organizations are designed to alleviate many of the problems of this information-processing nightmare. Decisions are inherently made at the project manager and department head level, thus alleviating the long waiting time associated with top-level (Chief Executive Officer) organizational decisions. Used correctly, the matrix design develops people to take on a greater general management role and increases the organization's information-processing capacity. (Davis and Lawrence, 1977, pp. 14-16)

c. Pressures for Shared Resources

The final condition which merits consideration for an organization's adoption of matrix structure is the pressure associated with ensuring full utilization of resources (labor and capital) and meeting high performance standards demanded by customers (Davis and Lawrence, 1977, pp. 17-18). To compete in high-technology industries, corporations must make full use of capital and labor resources. Each of these resources is associated with a cost to the corporation. Technical expertise as well as the

capital resources necessary to produce high-technology products are often wasted during down periods (Davis and Lawrence, 1977, pp. 17-18). As one project is completed or under a "stop work" status, labor and capital resources sit idle waiting for another assignment. Cutting the "down" time associated with these resources is a primary concern within any corporation. Matrix organization can provide an answer to this situation. Under the matrix design, as one project is completed or in a hold status, human and capital resources are shifted to other on-going projects with reduced loss in labor hours. Similarly, specialized equipment is shared by many separate projects simultaneously using a scheduled timeline. (Davis and Lawrence, 1977, pp. 17-18) For example, an aerospace industry's wind tunnel can be used by numerous projects (rotary wing, fixed wing, and research and development) and departments on a continual basis, even if one project is cancelled. The ability to make maximum use of these human and capital resources on a continual basis is a key facet of matrix organizations.

E. DoD PERSPECTIVE /POLICY ON MATRIX ORGANIZATION

One of my subsidiary research questions addressed how DoD acquisition programs are organized: in other words, what policies or directives dictate how a program office is organized? Both Army Regulation 70-1, Army Acquisition Policy, and Army Acquisition Executive (AAE) Policy Memorandum 91-4, Matrix Support Policy for Program Executive Officer Managed Systems, provide insight to the question. Army Regulation 70-1 consolidates the offices involved in the acquisition process into two distinct categories: program management and program supporting. The first of these categories is program management, which consists of Program Executive Officer offices.

According to AR 70-1, Program Executive Officers (PEOs) and program managers (members of the Program Executive Officer organizations) are given the authority and resources to manage program cost, schedule, and performance. (AR 70-1, 1993, p. 11) In other words, Program Executive Officer organizations make up what is commonly referred to as the supported commands.

The second category identified by AR 70-1 is the program supporting commands. This category includes the Army Materiel Command (AMC), the United States Army Information Systems Command (USAISC), and the United States Army Strategic Defense Command (USASDC). According to AR 70-1, the mission of these "materiel commands" is to provide the support needed by the PEOs in such a way as to ensure program success. The support provided by the materiel commands consists of both material and personnel. (AR 70-1, 1993, p. 11) Therefore, the materiel commands make up the functional base, and are responsible for providing the "personnel pools" from which matrixed workers are drawn as program offices are established.

In terms of acquisition program accountability, the Packard Commission and the Defense Management Review suggested that a more efficient and accountable work force was necessary to improve systems acquisition. In response to these findings, AR 70-1 states that the PEO or program manager (PM) has the ultimate accountability for mission accomplishment until transition to fielding. Accordingly, the PEO is accountable for directing the development, acquisition, developmental testing, modification, and fielding of assigned programs. Materiel commands, on the other hand, are held accountable for material release and the quality and completeness of the functional tasks and activities

which support the PEO. Program success, then, is based on the materiel commands' matrix support which serves to unify the PEOs and the materiel commands into a team effort dedicated to the development and fielding of weapon and information systems. (AAE Policy Memorandum 91-4, 1991, pp. 1-3)

While these two publications provide guidance on overall responsibility and accountability, they still do not completely answer the question of how a program office is organized. Based on interviews with senior officials, the organization of program offices differs among Program Executive Officer offices throughout the Army. As program offices are established, each PM has both a core set of personnel and a set of supporting matrixed personnel. The guidance that PMs have received to organize their offices is the organizational Table of Distribution and Allowances (TDA), which is dictated by each PEO office. Therefore, while it may be ideal to have each PM decide on the type of organizational structure, and amount of matrix support his organization needs, he is normally forced to manage with the type of structure and authorized TDA dictated by his parent organization (i.e. the philosophy of the PEO, and other senior DA and DoD managers). Other influences which may contribute to determining the type of organizational structure and the organization's TDA include: type of program, budget, and Government employee utilization. (Matthews, 1995)

To illustrate the organization of a typical program office, Figure 2.4 displays the organization of the Army Tactical Missile System (TACMS) under the Tactical Missiles PEO.

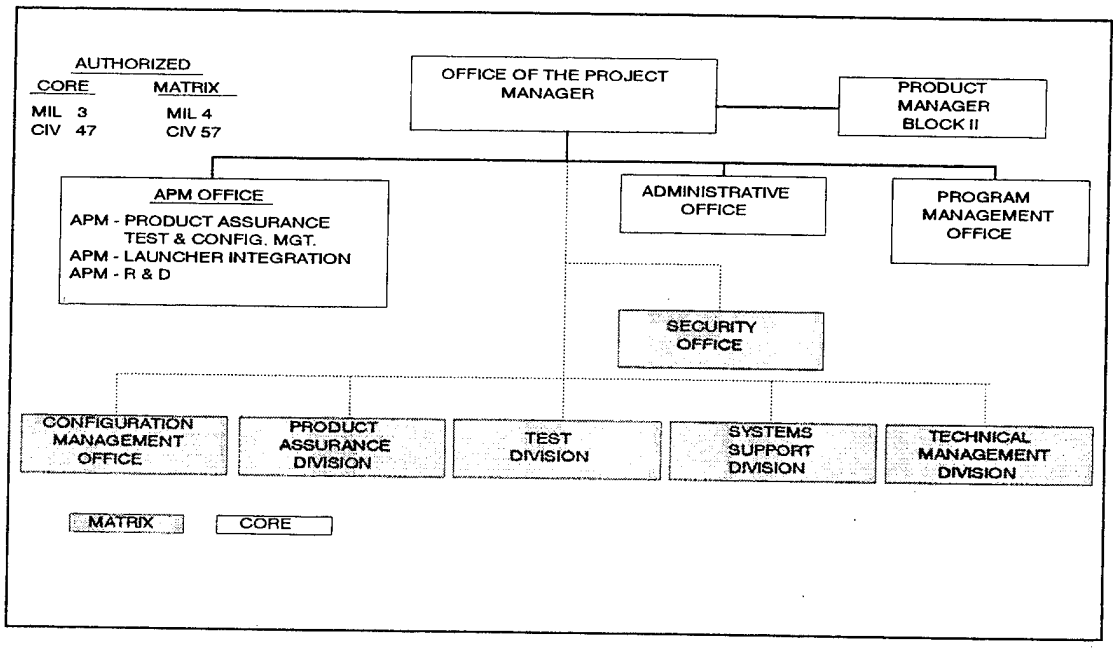

Figure 2.4. Army Tactical Missile Project Office, March 1994 (Matthews, 1995).

As shown in the diagram, more than half of the organization' personnel are matrixed from the supporting materiel commands throughout the Department of the Army (DA). Divisions containing matrixed personnel include Configuration Management, Product Assurance, Test, Systems Support, Technical Management, and the Security office.

While Figure 2.4 represents a typical program office, it is not necessarily representative of all program offices under the various PEO offices. As stated earlier, each PEO's philosophy regarding organization differs. Therefore, standardization within program offices does not exist. Instead, each PEO is held accountable for directing the development, acquisition, modifications, and fielding of assigned programs. The type of structure used by PEOs to accomplish these tasks, however, is predominately matrix. (Matthews, 1995)

Thus, while matrix structure is not necessarily dictated, it is more prevalent. This is due primarily to the factors presented earlier. The type of program has a tremendous

effect on what type of organization is chosen. Most acquisition technologies require highly technical specialization, and by definition, require matrix organization. Because Research and Development dollars are in short supply due to DoD downsizing, many program offices cannot afford to maintain large, experienced staffs. Therefore, they must use matrix personnel to provide budget flexibility. In addition, there is a strong emphasis to keep DoD civilian employees active. In other words, when a portion of a project is completed, matrix personnel are returned to their functional bases and proceed on to other projects as required. If program offices were structured differently, such as a project-oriented structure, movement between cycles of a program could require implementation of reduction in force (RIF) procedures. It is readily seen why the majority of PM offices are structured as matrix organizations. PM's are more or less forced into this structure by the factors presented, rather than any policy or regulation. (Matthews, 1995)

1. Matrix Support Plan

While AR 70-1 and AAE Policy Memorandum 91-4 do not explicitly dictate program office organization, they do provide policy on matrix support implementation. Each states that in order for the PEO or PM and the materiel commands to carry out their tasks, a plan is necessary to delineate the relationship between the two parties. This plan is normally in the form of a Memorandum of Understanding (MOU), which contains the functional tasks required by the PEO, the funds to be provided, and the manner in which the materiel command will accomplish the tasks. Additionally, the PEO or PM must coordinate the Program Baseline Agreement with the appropriate materiel command in order to ensure that program tasks are properly supported. Finally, the PEO or PM is

required to identify program tasks needed to successfully accomplish their mission (by preparation of a series of integrated support plans such as the Integrated Logistical Support Plan, the Configuration Management Plan, the Systems Engineering Master Plan, and the Test and Evaluation Master Plan.). This step is crucial in order for the materiel command to identify all resources necessary to ensure accomplishment of the tasks. (AR 70-1, 1993, p. 11)

As with any "living document", the support plans are updated as necessary to incorporate any modifications as plans change. If resource requirements change, the funding and schedule are changed appropriately in order to take into account differences in total funding amounts. It is important to note that support plans are joint documents, and therefore, changes cannot be made unilaterally. (AR 70-1, 1993, p. 11)

2. Personnel Management and Resolution of Functional Conflicts

To help alleviate some of the pathologies involved with matrix structure, both AR 70-1 and AAE Policy Memorandum 91-4 provide guidance for personnel management and the resolution of functional conflicts. One pathology of matrix structure includes personnel management (see Chapter III Matrix Strengths and Weaknesses). In order to alleviate problems with performance evaluations of matrix support personnel, AR 70-1 provides that while materiel commands have overall responsibility for the performance evaluation of the matrix personnel they provide to the PEO or PM, PMs must have the ability to influence these evaluations. (AR 70-1, 1993, p. 11) This is based on the PM's overall accountability for mission accomplishment of their assigned systems. This

inclusion of the PM into the rating scheme of matrixed workers provides him with the ability to influence each worker's performance and potential for increased responsibility.

Another pathology found in matrix organizations is conflict. AR 70-1 and AAE Policy Memorandum 91-4 provide guidance concerning the resolution of functional conflicts. Each state that resolution of issues is to occur at the PEO/PM and local materiel command level for the mutual benefit of all involved. However, when resolution at lower levels is impossible, regulations state that the conflict is to be elevated through the PEO and materiel command chains to the AAE for final resolution. (AR 70-1, 1993, p. 11)

F. CHAPTER SUMMARY

This chapter introduced the concept of matrix organizational structure and its evolution as an organizational form. In an attempt to understand the complexities associated with matrix structure, a thorough discussion of both functional and project structures was included. Discussion emphasized that the matrix structure was developed in an attempt to take advantage of the strengths while minimizing the weaknesses of both the functional and project structures. The matrix was defined as an organizational structure in which individual workers fall under one manager (department head of a functional division) while working as part of a concerted effort (defined as a project) under a different manager. Next, the chapter discussed several prerequisite conditions which are necessary for an organization's management to consider before adopting a matrix structure. These conditions include: outside pressure for dual focus, pressure for high information-processing capability, and pressure for shared resources.

Finally, the chapter discussed DoD's perspective and policy on matrix organizational structure. While published regulations give little guidance on how program offices are to be organized, they do provide numerous qualifications on how PEOs/PMs and materiel commands are to work together as part of a unified effort to develop and field weapon and information systems. An example of a typical program office was presented in order to show the amount of matrixing which is common among many PEO offices. The chapter ended with a discussion of two Army policies which are designed to alleviate some of the pathologies common to matrix structure. An in-depth discussion of matrix strengths and weaknesses will be the focus of Chapter III.

III. MATRIX ORGANIZATION STRENGTHS AND WEAKNESSES

A. INTRODUCTION

Now that I have defined matrix structure, and given conditions for its implementation into an organization, it is time to identify and discuss matrix strengths and weaknesses. As discussed earlier, matrix structure was adopted by aerospace and defense organizations in an attempt to retain the benefits of both the functional and project organizations while avoiding their inherent disadvantages (Patterson, 1978, p. 11). Therefore, an organization's success under matrix depends on management's ability to take advantage of the structure's strengths while, simultaneously, limiting its negative aspects or weaknesses. The intent of this chapter is to describe and discuss some of the more prevalent matrix structure strengths and weaknesses found within both commercial and DoD organizations.

B. MATRIX STRENGTHS

Once an organization determines a need to evolve into a matrix, the leadership needs to evaluate the benefits and costs associated with matrix organization evolution. It must be reemphasized that matrix is not for every organization. Nor is any one form of matrix readily adaptable to various organizations.

Many of the reasons identified for creating a matrix organization are benefits in themselves. Some of them however could use further definition.

1. Manage Dual Environmental Demands

The capability to manage dual environmental demands was one of the primary reasons that matrix organizations were developed. The matrix was designed to assimilate

the processing of a huge volume of information from various projects while simultaneously providing overall management for the entire organization. The goal is to provide undivided human resources to various tasks or projects simultaneously. (Davis and Lawrence, 1977, p. 13) The key word being *undivided*: ensuring that an employee is not required to split his talents among various jobs at the same time.

Conventional organizational designs flowed decision-making to upper management. As organizations, especially those in high-technology industries, developed and diversified, the number of critical decisions requiring management action grew exponentially (Davis and Lawrence, 1977, p. 11). Upper management soon became inundated with decisions on specific projects or technologies that they were unfamiliar with. The end result was poor, uninformed decision-making. The matrix design is intended to empower decision-makers at lower levels than conventional functional organizations. This structure forces authority and responsibility down to the specialist level. Therefore, a positive aspect common to matrix structures is that decisions are more timely and accurate and invoke personal involvement and employee commitment. (Davis and Lawrence, 1977, p. 14)

Regardless of good intentions, decision-making is only accelerated if more decision authority is delegated to decision makers at the program level. In weapon systems acquisition, where decision-making is a highly-structured and jealously-guarded prerogative, significant decision-making authority is maintained at least one level, and often several levels, above the program manager (Patterson, pp. 12-13). Thus, while

matrix is designed with the intent of taking advantage of lower level decision-making, proper implementation is still in the hands of management.

2. Flexible Use of Specialized Personnel

Another positive aspect of matrix organizations is that matrixed specialists are assigned and reassigned to maximize both their potential and the needs of the projects they are assigned to. When a specific task or project is complete, individuals return to their functional base where they are available for reassignment accordingly (Davis and Lawrence, 1977, p. 17). If, for instance, a specific project is not meeting its program baseline due to problems with engineering, the project manager has the flexibility to "hire" more engineers to help isolate and correct the problem. When the problem is corrected, the "hired" engineer returns to his functional base and is reassigned to another task. This sharing of personnel within the organization to meet the diverse technological needs of customers saves the organization a great deal of money that would have otherwise been spent on permanent salaries. Additionally, matrix personnel have the resources and benefits of a large organization from which to draw, yet they retain that small-group autonomy that fosters creativity and innovation (Davis and Lawrence, 1977, pp. 16-17). The benefit is a focused and resourced professional who is free of the bureaucratic politics of a large organization. The organization, on the other hand, retains it's economies of scale while encouraging small team independence and innovation.

Matrix professionals tend to be more mobile and accustomed to moving within various jobs. This reduces the amount of time required to "acclimatize" a new employee.

3. Adaptability to External Change

The third benefit of matrix organizations involves flexibility. Initially, many projects may be ambiguous in nature. The actual support requirements may not be known. This is especially true in high-technology research and developmental areas where the design and technologies are still being developed as the project matures (Davis and Lawrence, 1977, pp. 14-15) As the project experiences success, the personnel requirements may change. Quick deployment of highly-skilled professionals can ensure that timelines are maintained, and that the project moves forward at the optimum rate.

Although the high-technology fields pursue change, organizational change creates turbulence that can have a detrimental affect on the productivity of an organization. The matrix design is such that new activities can be incorporated or cancelled without a drastic structural change. As a project is cancelled, the matrixed individuals are "released" to their functional base and reassigned to another project. The end result is less organizational turbulence with greater functional flexibility. (Skowronek, 1976, p. 9)

4. Personal Skills Development

The final benefit common to matrix structure deals with individual development and professional growth. The evolution of a matrix organization causes its employees to develop new behavior patterns, new technological skills, and greater interpersonal communication abilities (Davis and Lawrence, 1977, p. 107).

The behavioral pattern of matrix professionals is very open yet non-confrontational. Most enjoy constantly changing environments as well as personal and professional risk. This is driven by the complexity of their job and the uncertainty in

their environment. Matrix professionals tend to be more emotionally energetic, self-starting, and better team players. This, in theory, leads to a greater level of personal responsibility and less organizational direction. Employees feel that they have more personal freedom and power. The end result is a constantly learning organization that shares its knowledge within. (Davis and Lawrence, p. 107)

Most matrix organizations require that their employees return to their functional "home" after spending time with a work team at a project location. Within this functional home, the latest developmental news is shared among the employees (Davis and Lawrence, 1977, pp. 16-17). New technology is spread throughout the group to educate, and to ensure that repeated mistakes are avoided. This information sharing (corporate memory) keeps all members of the group informed and ready to share their expertise with the next project or program they are associated with. (Losi, 1977, p. 5)

It is important to note that the big difference between personal skills development theory and actual practice is training. To assume that an employee can walk into a matrix environment (assuming they have spent a considerable amount of time in a functional environment) and simply change their behavioral and work patterns, is unrealistic. It is essential that prospective matrix personal are thoroughly trained on the workings, environment, and stresses associated with this type of organization. Although this training comes with a cost, the end result, an aggressive, self-starting, effectively-communicating professional, is definitely a benefit. (Przemienieki, 1993, pp. 53-57)

C. MATRIX WEAKNESSES

Matrix structure, like any other organizational form, can suffer from a variety of pathologies. One of the principal objectives of this research effort was to identify some of the more significant weaknesses encountered in matrix organizations, especially as they affect the managerial functions of the program manager. Many of these weaknesses may occur in more conventional organizations, but the matrix seems particularly vulnerable to these ailments. For matrix to work, managers must become familiar with these common weaknesses in order stop them from hurting the organization. Several of these weaknesses include authority ambiguity, management conflict/power struggles, worker conflict and confusion, communication, and anarchy.

1. Authority Ambiguity

One significant weakness present in matrix organizations is the fostering of ambiguity in the traditional concept of authority. By definition, matrix structure falls half-way between pure functional and pure project structures. Thus, both functional and project managers participate in a dual authority relationship at some level in the organization. Inherent within the dual authority relationship is a power balance between the project management and functional sides. When clear lines of authority are not present, authority ambiguity becomes a serious problem. (Losi, 1977, pp. 9-10)

Recipients of the ambiguity of authority condition often include subordinates who become affected by an overlap in lines of authority. Research indicates that subordinates are often confused as to who has the authority to make crucial decisions concerning a project. Unfortunately, subordinates are not the only ones who are confused, as often

both the functional and project managers disagree over decision authority. (Losi, 1977, pp. 9-10)

Avoiding the ambiguity of authority issue is often as simple as clearly defining, in writing, the relationship between the functional and project managers. Other organizations which have adopted the matrix structure grant authority based on the type of matrix used. In this case, any one of three types of matrix structures are installed: a coordination matrix, a balanced matrix, or a project matrix . To illustrate this method, the following distinction between administrative tasks is necessary: operational task (deciding what project tasks should be done and when), executive task (deciding which of the personnel carry out tasks and how), and resource maintenance task (procurement and maintenance of departmental resources, both human and material). In a coordination matrix, project managers do not obtain any authority. Instead, they assist functional managers in coordinating interdepartmental decisions. A balanced matrix represents an even balance or compromise between a functional and a product type of organization. In this case, project managers get operational authority, while functional managers retain executive and maintenance authority. Finally, in a project matrix, project managers obtain complete authority regarding project activities, as well as operational and executive matters. Under this form, functional managers' involvement is limited to the maintenance of departmental resources. (Laat, 1994, pp. 1089-1090) To succeed in avoiding this pathology, senior management within matrix organizations must make determinations regarding functional and project managers' authority. Their failure to properly set the "ground rules" normally results in an environment of indecision and ambiguity.

While the ambiguity of authority weakness is significant, it also serves as a root cause for several other weaknesses found in matrix organizations. Perhaps the greatest weaknesses caused by this condition are the power struggles and conflicts which occur between the functional and project managers.

2. Management Conflict/Power Struggles

One weakness common to matrix-based organizations deals with power struggles and conflict. As stated earlier, matrix personnel fall under the "two boss" concept. Thus, they are subject to the management actions of both their functional and project managers. Unfortunately, goals, objectives, concerns, and philosophies are not always shared between these individuals. When there is disagreement with any of these areas, conflict occurs. (Przemienieki, 1993, pp. 53-57) As a simple example, consider a department manager who schedules functional department meetings each Friday in order to share the latest technical information found in any of the corporation's on-going projects. The meetings generally last the entire day, and are the source of excellent information sharing among the personnel in the department. However, on the project side of the house, the project manager of a multi-million dollar project that is behind schedule needs the same individuals working on project-related material throughout the entire week, including Fridays. All the prerequisites are in place for a classic power struggle to occur between the two respective managers. If the two managers are unable to agree on the organization's goals, conflict ensues.

Authority over manpower represents just one example of the conflict that can exist within matrix organizations. Other items which give particular rise to conflict generation include:

1. Conflict over schedules
2. Conflict over priorities within the project
3. Conflict over technical issues
4. Conflict over administration
5. Conflict of personality
6. Conflict over costs (Losi, 1977, p. 12)

Interestingly enough, another source of managerial conflict occurs during the introduction of matrix into an existing organization. In this case, functional managers find their authority further reduced, as authority now comes both from above their functional departments, and from project managers located laterally across their departments (Laat, 1994, p. 1090). This condition often equates to a loss of authority on behalf of functional managers and is exacerbated by a divergence in viewpoints on behalf of everyone involved. While the project manager is responsible for meeting project goals within a specified time-span and budget, functional managers are concerned that their departmental resources, human as well as material, are used effectively and are kept in good condition. In this case, "turf war" conflict becomes a force of will as all parties attempt to achieve their goals. (Laat, 1994, pp. 1089-1090)

Unfortunately, conflict-based "turf wars" can occur in any matrix organization, regardless if they are internally or externally based. Organizations in which functional and project managers are able to build both a professional and personal rapport with one another are less likely to experience power struggles and conflict (Davis and Lawrence, 1977, pp.106-107). In these circumstances, the managers on both sides are able to place

the needs of the corporation over the needs of their respective domains. Hence, they are willing to cooperate and mutually identify priorities within their areas for the benefit of the corporation. With this shared vision and the corporation's best interest in mind, the functional manager, in the conflict of personnel example mentioned earlier, would readily make exceptions to the attendance of the members working on the project that was behind schedule. With cooperation between managers, matrix organizations can overcome this common structural pathology.

3. Worker Conflict and Confusion

Closely related to the management conflict pathology is another weakness defined as worker conflict and confusion. This common pathology with matrix organizations deals with the dual authority structure. While this "two boss" syndrome is closely tied to the pathology of managerial conflict and power struggles described earlier, it entails a change in perspective. By definition, the conflict and confusion pathology involves the matrix workers, and not the managers.

Under matrix structure, individual workers normally "belong" to their functional department for administrative and personnel purposes (Davis and Lawrence, 1977, p. 8). This arrangement dictates that the functional manager, not the project manager, conducts performance ratings on personnel in the organization. Thus, even though an individual worker has been assigned to a project for the past year, and is based across the country from his functional home, the functional manager retains the right to evaluate the worker's performance. This situation is not uncommon among both industry and DoD matrix-based organizations, and creates a climate of dissatisfaction among matrix workers. Workers

who are involved in a project believe that regardless of the quality of their work, other workers involved in performing tasks at their functional base's home station will be given preferable treatment on performance evaluations. This "out of sight, out of mind" environment common to matrix organizations contributes to the conflict and confusion pathology. (Matthews, 1995)

Further expanding upon the conflict and confusion pathology, matrix workers can easily find themselves involved in the management power struggle pathology described earlier. Under many conditions, the power struggle between the functional and project managers can and does flow down to individuals located within both the functional and project offices (Davis and Lawrence, 1977, pp. 129-130). In extreme cases, the conflict can be so intense that matrix personnel are confused as to whether or not to follow the instructions given by the project manager because he is in direct confrontation with their functional manager. In the end, matrix workers side with the individual manager who writes their evaluations - the functional manager. Under these conditions, project managers may feel that they have little to no control over their matrix personnel.

Although this situation represents a severe case, one can begin to understand how matrix personnel are affected by the "two boss" matrix structure. If the organization is not managed correctly, matrix personnel find themselves in a climate of inequality and confusion.

4. Communication

Communication is extremely important in any organization and probably more so in a matrix. As previously discussed, matrix organizations are unlike the more traditional

hierarchial organizations. In fact, it can be argued that they are inherently more complex. It is this complexity that adds a new dimension to communication within the matrix organization.

Throughout the research conducted on matrix organizations, the communication pathology was continuously mentioned in relation to other topics such as management conflict or power struggles. This literature states that communication is much more complex and difficult in a matrix structure than in a traditional organization. One of the main challenges to effective communication often addressed is the different and "new" structure. The interdependencies of a matrix simply require increased communication. However, this increased communication creates new problems. For example, in a functional organization, roles are structured so that the individuals can usually resolve conflicting demands by talking to their own functional boss. In a matrix, these differences are resolved with people from different functions who often have very different perspectives. (Losi, 1977, pp. 14-15)

Another issue that is repeatedly mentioned in the literature involves the constant changing of teams and team members. The changing nature of work in matrix organizations causes teams to be continuously disbanded. Because new teams are always forming, lateral and vertical communication must be continually stressed. Communication often starts off poorly and over time, becomes more effective. New members, or entire new teams, must learn the norms of communication within their new organization. Often these norms are informal, making the transition even more difficult. (Davis and Lawrence, 1977, pp. 129-132)

Ineffective informal communications represents another concern inherent to the communications pathology. While formal communication is extremely important to organizational success, informal communication within an organization is absolutely critical for effective day-to-day operations. After all, informal communication serves as the most basic form of lateral coordination. Informal communication channels cannot become effective overnight. They often take months, even years, to develop in an organization. Because personnel change frequently in matrix organizations, the effectiveness of informal communications may take longer to mature. In addition, new personnel must learn the informal ways each time they come aboard.

Another possible reason why poor communications exist within matrix organizations is the presence of an increased number of managerial layers. While this condition is inherent to matrix structure, it is virtually non-existent in traditional hierarchial organizations. These layers, or lines of authority, make lateral communication difficult, if not impossible. Additionally, the physical distance that separates DoD matrix personnel from their functional base, compounds lateral communication problems. To alleviate this, successful matrix personnel have been able to balance the need for lateral communication between their project and their functional base. (Losi, 1977, p. 15)

To deal with this ever-changing communication environment, managers and operating personnel have to be educated and trained to work in this area. New technology such as E-Mail and electronic data bases have made communication easier. However, new technology alone cannot solve all the problems. New techniques need to be developed to handle the complex communication problems of matrix organizations.

Managers and technical personnel will require additional knowledge and skills as well as modified attitudes if they are to communicate effectively in these new, sophisticated organizations.

5. Anarchy

One problem that occasionally occurs in organizations that have adopted a matrix form is anarchy. Anarchy is best defined as people's reluctance to fully inculcate the structure of the new organization (in this case the matrix) by formally defining that structure so that it can be effectively used. As organizational structures change, people have a tendency to fear the "unknown" and feel threatened by the new structure as it is presented. No clearly-defined organizational structure is emplaced. The end result is a freeform type of organizational structure that is somewhere between the old structure and a true matrix. This is often referred to as a latent matrix. Clearly-defined roles and lines of communication are not developed for use within the new matrix organization. (Davis and Lawrence, 1977, pp. 131-133)

This lack of organizational structure is very taxing on the internal lateral communications of the organization. As the organization matures, communication becomes even more difficult. For example, suppose a manager were given the responsibility to complete a task that required coordination with various departments within the company. There are however, no formal agreements or systems in place to help the manager accomplish his task. He has to cross functional lines of authority to try and get resources necessary to meet the company's objectives. As communications weaken, production and sales figures begin to drop. The manager, now fully frustrated,

tries to push harder on the functional departments to meet his needs. The end result is basic employee anarchy: the manager fails. Additionally, when this type of situation occurs, the immediate response is that the matrix is ineffective. Often the end result of the previous example is complete abandonment of matrix organization as a viable form of management. (Davis and Lawrence, 1977, pp. 131-133)

Research indicates that proper human resource planning is critical to preventing a situation that leads to anarchy (Davis and Lawrence, 1977, pp. 131-133). The matrix organization requires managers who think differently from functional or project management. Because of this, matrix management almost needs to be "grown" within the organization. There is a certain culture that is developed within a functional environment. Over time, this culture becomes essentially internalized into the group's way of life. Changing that group culture will have a serious effect on the organization (Bolman and Deal, 1991, p. 103). Managers who spend a considerable amount of time in the functional arena have serious difficulty adapting to the matrix mentality (two-bosses, decentralized control). Unfortunately, growing your own management sometimes restricts innovation and prevents fresh ideas from entering the organization. Additionally, it takes a considerable amount of time to groom skilled managers who may be needed immediately (Davis and Lawrence, 1977, pp. 116-117).

6. Other Areas

The problem areas described earlier (authority ambiguity, management conflict/power struggles, worker conflict and confusion, communication, and anarchy) are significant areas of concern to managers operating within a matrix organization.

However, this list is by no means exhaustive. Other areas of significance are cited by various researchers. These include the following:

1. Anxiety by project personnel over loss of employment as projects near completion.

2. Lack of career development afforded to project specialists.

3. Low sense of loyalty from project assigned personnel due to the perception of a transient state.

4. Over-specialization of personnel who are collocated (inability to share in home/office experience and development).

5. The matrix form of organization fosters an increase in the number of management levels. (Losi, 1977, pp.19-20)

6. Matrix results in a complex managerial structure (Losi, 1977, pp. 19-20)

While matrix structure has many pathologies, it is assumed that the disadvantages of the matrix organization are outweighed by the benefits of efficiency and increased productivity.

D. CHAPTER SUMMARY

This chapter has introduced and discussed several strengths and weaknesses of the matrix structure. The strengths of matrix structure included 1) management of dual environmental demands, 2) flexible use of specialized personnel, 3) flexibility to external change, and 4) personal skills development. Matrix pathologies discussed in the chapter included 1) authority ambiguity, 2) management conflict/power struggles, 3) worker conflict and confusion, 4) communication, and 5) anarchy. Several of the matrix pathologies involved discussions of preventative measures which are available to reduce an organization's probability of encountering the possible weakness. Successful

management in a matrix environment is based on the awareness of the merits and drawbacks of the organizational form. Matrix was conceived with the intent of being able to manage in a high priority, technically demanding and rapidly changing program environment. If the matrix structure is to survive and meet these challenges, managers must determine the best ways to take advantage of its strengths while, simultaneously, eliminating or reducing the effects of its weaknesses.

IV. MATRIX STRUCTURE IN ARMY ACQUISITION PROGRAM OFFICES

A. INTRODUCTION

While Chapter III discussed many of the published strengths and weaknesses of general matrix structure, Chapter IV narrows the focus, and introduces the observed strengths and weaknesses of the matrix structure within Army acquisition program offices. This chapter also discusses how program managers throughout the Army have attempted to maximize the attributes of matrix, while simultaneously finding ways of minimizing its weaknesses. The intent of this chapter is to formally document the knowledge and experiences offered by program managers in order to draw some conclusions with respect to optimizing an organizational structure which is likely to remain the way the Army manages acquisition in the foreseeable future.

B. DEMOGRAPHICS

In order to obtain a true cross-section of ideas, experiences, and opinions, I conducted interviews with 18 program and major subordinate command (MSC) managers. Program manager input came from within the following Program Executive Offices: Armored Systems Modernization, Aviation, Intelligence and Electronic Warfare, Tactical Missiles, Tactical Wheeled Vehicles, and Cruise Missiles Project and Unmanned Aerial Vehicles Joint Project. Major subordinate command input was provided from within the Missile Command (MICOM). The PMs who were interviewed had an average of ten years in program offices, and an average of five and a half years of matrix experience. The mixture of personnel chosen was based upon a desire by the researcher to include

both the supporting and supported organizations within the matrix structure. The general comments and information provided throughout this chapter represent data gathered from both the functional and program sides in order to allow the reader to develop his own conclusions regarding the published information.

C. OBSERVED MATRIX STRENGTHS

Program managers and MSC managers did not hesitate to point out the strengths offered by the matrix structure. While many of the PMs' and MSC managers' opinions agree with the published literature on matrix strengths, many of the comments are unique to the Army program office environment. This situation is to be expected, as established matrix structure often varies from organization to organization. In general, the interview process revealed two broad categories of strengths offered by the matrix structure. These categories are flexibility and increased access to knowledge.

1. Flexibility

One hundred percent of the program managers interviewed included flexibility as the matrix structure's greatest strength. Regardless of the individual's opinion of the overall success of the matrix structure, none could argue with the advantages offered under this particular strength. The ability to quickly add, replace, or delete personnel from a program in an expeditious manner provides the program manager with an extremely beneficial attribute. While this attribute may suggest that program managers are in a constant state of adding or deleting personnel from their programs, this is simply not the case. The Army's current organization dictates that program managers and major subordinate commands establish Memorandums of Agreement (MOA) each year. These

MOAs establish requirements for personnel support needed by the program offices. Based upon the total number of programs supported by each individual MSC, personnel within the command are shifted and organized as necessary from within their functional base in order to support the program offices. The MOA procedure helps the MSCs make personnel decisions regarding the support they should provide to the project offices. However, each MSC realizes that project offices can add or release individuals as necessary during the year in order to react to unforeseen changes in funding, technological issues, or program direction. To assist the MSCs in this process, many PMs choose to include options in the MOAs which can be activated based upon certain sets of circumstances. (PM/MSC manager, 1996) This procedure is normally done when the PM is uncertain about the upcoming year's requirements.

Personnel changes are requested by PMs for numerous reasons. First, changes in the program scope may require skill changes. This is often the case when programs move through a milestone decision into the program's next phase. For instance, projects entering into the Engineering and Manufacturing Development (EMD) phase from the Demonstration and Validation (DEMVAL) phase often create a need for more production engineers and testers as opposed to design engineers. Matrix structure allows the PM to transition the necessary personnel (add and delete) from their functional organization based on his request to the appropriate MSC. If project offices were structured under a conventional project structure, personnel would have to be released and hired in order to achieve the same result.

Another reason why PMs request personnel changes is due to dissatisfaction with the performance of an individual matrix worker. In this situation, the matrix worker either lacks the sufficient background, education, or desire to accomplish a task. Program managers are able to simply notify the major subordinate command that the individual worker is not producing up to a desired level, and the individual is replaced. Program managers who do not receive an immediate response from the MSC, may simply stop paying the individual's salary until he is replaced. While this set of circumstances is rare, it is an effective way to get the MSC's attention. (PM/MSC manager, 1996)

Unfortunately, changes in personnel are not always dictated by the program manager. Each MSC has the ability to remove and replace personnel serving under a project as well. This is done by the functional office when they believe the individual matrix worker needs to gain experience elsewhere as part of a promotion effort, or when the individual has been determined to be next in line for additional education or training. Under these circumstances, every program manager interviewed understood the need for replacement. In the words of one PM, "...when a replacement is done for experience reasons, or for promotion reasons, you just cannot turn that down as you are dealing with someone's career at that point." (PM, 1996) The problem with replacements is twofold. First, many program managers feel that the MSCs do not always replace matrix personnel based upon their career progression. Instead, many of the program managers interviewed felt that they received replacements simply because the MSC needed to find a position for a subcaliber person, or when another project needed the benefit of a certain talent.

In the end, the first project office receives a subcaliber person while another program supported by the MSC benefits from the exchange.

The second problem with replacements involves training. While the matrix structure allows program managers the flexibility to replace current workers, the time involved with bringing a new member of the office up to speed on the current status of the project is often measured on a scale of months instead of hours or days. While this situation is often accepted as one of the costs associated with the professional advancement of a former employee, it becomes an unacceptable cost when an individual is replaced for other than professional reasons. If the second case is allowed to occur, animosity between the PM and the MSC is the inevitable result.

2. Increased Access to Knowledge

The second strength of matrix structure involves the increased access to knowledge. When a matrix worker enters a program office, he does so knowing that he has access to large amounts of experience and knowledge from his peers who remain at the functional base. The benefit of this condition is that it allows individuals with limited expertise to be able to draw on experience from within their functional area to help them get over the hurdles which they do not have the necessary expertise to do themselves.

While this strength seems to be extremely efficient and attractive, it must be put it into perspective. First, this strength mainly benefits smaller project or product offices as opposed to larger program offices. The rationale for this statement is relatively simple. First, smaller project or product offices receive less funding, making the number of both core and matrix support personnel smaller than that of larger program offices. Thus,

instead of having the luxury of 20 - 25 design engineers, a product office may contain as few as two. Fortunately for the product office, these two engineers have the ability to remain in close contact with their functional organization. This attribute allows them to draw from the experiences and education of many engineers, thereby increasing their knowledge base to levels similar in number to those employed by a larger program office. In the end, two engineers give a product office a level of knowledge which is comparable to an office consisting of many engineers. (PMs, 1996)

While this strength is noted for assisting smaller project and product offices, does it assist the larger project and program offices as well? Based upon interviews, the answer to this question is no. While matrix personnel located within larger program offices have the same ability to draw from the functional command as do their counterparts in smaller project and product offices, the need to do so is reduced based on the sheer numbers and levels of expertise available from matrix workers within the program office itself. Thus, while this strength allows smaller project and product offices to have increased access to talent that they would not normally be able to obtain, it does not automatically benefit the larger programs. (PMs, 1996)

D. OBSERVED MATRIX WEAKNESSES

While program managers and MSC managers were quick to point out the strengths of the matrix structure within Army acquisition program offices, each was equally willing to express his opinion on matrix weaknesses. As alluded to in Chapter III, it is impossible to find an organizational structure which is without fault, and the matrix

structure is no exception. The major weaknesses which the program managers identified fall into two broad categories: worker loyalty and worker selectivity.

1. Worker Loyalty

The worker loyalty category, which was identified by program managers as being a matrix weakness, actually consists of numerous facets. While many of the issues raised under this category are common to matrix organizations everywhere, several are only applicable to Army program offices. The facets which I will focus on include worker motivation and allegiance, and performance ratings and awards.

The first weakness identified by PMs involves worker motivation and allegiance. Prior to the introduction of matrix structure into Army, project offices were very large. The size alone allowed each project office to be completely self-contained with respect to the personnel needed to complete its tasks. During this period, there was no doubt where employees owed their allegiance to: the project office. With the introduction of matrix, this concept changed. Employees now became responsible to their functional office as well as their project office. It was at this point that the issue of allegiance surfaced. Who should the employee show his allegiance to? The answer to this question is not as obvious as it may seem, as employee allegiance is based upon a selected set of criteria. These criteria include the employee's physical working location and performance evaluation scheme. (PMs, 1996)

Matrix workers assigned to MSCs may support a program in one of two ways. First, a particular employee may be collocated with the project office. Under this set of circumstances, the program manager solicits the MSC to have the employee collocated

with the project office because the program is "employing" (and funding) the individual on a full-time basis. This type of matrix employee leaves his functional base, and works in the project office for as long as the program continues to fund him. The other possible support alternative available to program managers is non-collocated matrix. Under this scenario, the individual matrix worker provides some level of support (ranging from part-time to full-time) to the program manager, but does so from his functional base. This scenario is often used when the project office does not have the necessary office space available for the worker or does not require the worker's services for an entire year. Where does this leave the question of loyalty? Most of the program managers interviewed agreed that the answer to this question is largely personality-driven. However, according to one program manager, the difference is clear, "...there is a discernible difference between the level of responsiveness displayed by collocated matrix and non-collocated matrix personnel." (PM, 1996) Another program manager added, "...with collocation, the individual's loyalty lies with the PM shop. If they are not collocated, then their loyalties are diverse." (PM, 1996)

Perhaps the greatest reason why a significant loyalty issue exists between collocated and non-collocated matrix personnel, or between core and matrix personnel in general, is the performance evaluation and award scheme. As addressed in Chapter II, AR 70-1 and AAE Policy Memorandum 91-4 each require rating input from the PM. However, this policy has not been universally implemented. Thus, some of the PMs interviewed have yet to receive authority to rate matrix personnel within their program offices. This situation has implications on the loyalty issue discussed earlier. As stated

by one PM, "...if the personnel are core, you rate them, and thus there are clear lines of delineation as to where their loyalties lie...with matrix personnel, there is no such guarantee." (PM, 1996) While some of the PMs and MSC managers downplayed the importance of PM input to performance evaluations on matrix workers, elaborating instead on how their matrix personnel are motivated to perform based upon their allegiance to the product, every PM agreed that involvement in the rating scheme is important. As one PM stated, "...involvement in the rating scheme is important because it can enhance worker performance at times." (PM, 1996)

The current award system, like the performance evaluation system, differs between MSCs. As such, PM comments regarding the award system tended to vary. However, one point (and subsequent weakness) was clear. This point involves the policy regarding the amount of an award which can be made to an individual matrix employee. Major subordinate commands normally develop a policy regarding the monetary amount of award individuals may receive. The policy states that the total of monetary awards given during a fiscal year may not exceed 1.5% of the total salary of everyone assigned to the functional organization. Thus, while PMs have input regarding the amount of award they believe a matrix worker should receive, the functional command makes the final decision. This decision often results in a lower dollar amount than the PM requested. (PM/MSC manager, 1996) In the end, matrix workers who spend an entire year working within a program office are subject to the award policies and approval chain dictated by their functional organization.

2. Worker Selectivity

The second broad category of identified weaknesses involves worker selectivity. Like the worker loyalty category discussed earlier, worker selectivity consists of many facets. However, the common thread which binds these facets together is the inability of the PM to have complete control in determining which matrix worker he is provided.

Under project organizations, program managers have the ability to hire new workers as required to support their program. While this process may take time, the PM is eventually able to hire the person whom he feels can best fill a position. In contrast, the matrix structure may not allow the PM to be selective regarding his matrix staff. Instead, the PM is forced to initially accept everyone that the MSC sends him; replacing subcaliber performers over time. As one PM stated, "...the bad part is that you have less selectivity over who you get, and the quality of those personnel vary from average to good to superb." (PM, 1996)

Closely tied to this issue is the replacement of matrix personnel by the MSCs. As mentioned earlier, MSCs have the ability to replace personnel working in project offices at any time. While a replacement action is normally executed when a particular worker is approaching promotion, or when the worker is slated to obtain further education, this is not always the case. Unfortunately, PMs often find that MSCs replace their matrix workers in order to find a position for a subcaliber person, or because another project is in need of a certain talent. When either of these situations occur, the minimum damage encountered by the first project office involves the re-training of another worker. (PM/MSC manager, 1996)

The third weakness identified under the worker selectivity category involves barriers in accessing matrix workers from other MSCs. Army PEOs throughout the country receive their primary matrix support from a geographically close, and functionally-related, MSC. For instance, Program Executive Officer Tactical Missiles receives the majority of their matrix support from the U.S. Army Missile Command (MICOM), while Program Executive Officer Armored Systems Modernization receives the majority of their matrix support from Army Tank-Automotive Command (TACOM). Occasionally, PMs require a special form of expertise to assist their project. If the expertise is more abundant in a MSC which is not the primary supporter of the PM's PEO, the PM often encounters difficulty in obtaining it. As one PM stated, "...one weakness involves the relative inability to go to other commands that are more talented and can better meet my demands...it is painful at times as the attempts are resisted by the local MSC who wants to employ their own personnel." (PM, 1996) As another PM stated, "...we should have the flexibility to go to the source of the most expertise." (PM, 1996)

The resistance offered by the local MSC is both unfortunate and understandable. With the reduction of both personnel and available funds throughout the Department of Defense, MSCs are pressured to find employment for an increasingly larger number of personnel whom they can no longer hide within the command's overhead costs. In the end, MSCs "market" and "sell" a percentage of their personnel to the supported projects in order to avoid Governmental reductions-in-force. (PM/MSC manager, 1996)

The final worker selectivity weakness identified by PMs involves a growing lack

of competent technical personnel. In other words, some of the PMs interviewed felt that the MSCs were falling behind in developing the personnel needed to deal with the growing number of complex systems. As the PM of an extremely complex project stated, "...there is such a lack of technical competence that I have to rely on the prime (contractor) to tell me the truth as I have no one to tell me otherwise." (PM, 1996) Unfortunately, this situation is not likely to get any better. Until the current Government civilian hiring and promotion freeze ends, PMs will continue to face this predicament. As one PM stated, "...in the future, since we are neither hiring nor promoting, I feel that we will end up contracting out for all of this support ... because the matrix will not be able to provide it." (PM, 1996)

The two major weakness areas identified by the PMs and MSC managers represent problem areas which must be addressed and minimized if the matrix structure is to be optimized in the future. While one of the problems identified by PMs requires Congressional action to cure (hiring and promotion freeze), others simply require quality leadership to make the system perform. The final section within this chapter addresses some of the ways which PMs and MSC managers have attempted to optimize the matrix structure.

E. MAXIMIZING THE MATRIX STRUCTURE

Pointing out the problems associated with the matrix structure is only half the battle. The other half involves making the structure work, and work successfully. Contrary to basic human intuition, the fact that this two-manager structure even works at all is not due to some kind of divine intervention. Instead, it is more an issue of

leadership, cultural change, and personnel management. The implementation of these traits and beliefs have evolved the matrix structure into one which, while admittedly unpopular, can be effective. Here are some of the possible methods and organizational variants which PMs believe can (or already have) been used to improve or optimize the matrix structure as an effective form of organization within their project offices.

1. Collocation

Perhaps one of the biggest differences in the level of support provided by matrix workers involves the issue of collocation. As stated earlier, matrix employees can support the program office in one of three ways. First, the individual can physically work in the program office (often referred to as direct support). Next, he may support the project on a full-time basis, but work in his functional office instead. This is done in cases where the project office does not have the office space for the individual, or when the individual requires the extensive use of technical facilities which are only available at his functional base. The third way which matrix employees support a project is on a part-time basis (often referred to as general support). In this case, the individual works for, and is funded by, the project office for one-half or one-quarter of a man-year. Due to the part time nature of this situation, the matrix worker usually works at his functional base.

Each of the PMs interviewed during the course of this research believed that there is a significant difference between the level of support received from a collocated matrix worker verses that of a non-collocated one. As one PM stated, "...the worst case scenario is when your matrix personnel are not collocated, and you have no control over whether things are being accomplished at all...while the PM is still responsible, he has no clout

in getting things done." (PM, 1996) However, when matrix employees are collocated, PMs were quick to point out the difference, "...collocation is absolutely key and essential...we have both collocated and non-collocated matrix support, and I treat the collocated as essentially part of my core." (PM, 1996) The rationale for this belief is essentially simple. First of all, collocation enables matrix workers to work side-by-side with core personnel on a daily basis. Displaced from their functional base, matrix workers begin to take on the character of the project office. Over time, the rapid pace and teaming aspect associated with the project office begins to make matrix workers adopt a more project oriented identity. As one program manager stated, "...this creates environments of loyalty and this makes a big difference in the way people think about themselves and the program...the sense of belonging is important." (PM, 1996)

Can collocation help resolve the loyalty weakness pointed out earlier? According to one PM, it can: "One key item is collocation...with collocation, the individual worker's loyalty lies with the program office, while if they are not collocated, their loyalties become diverse." (PM, 1996) As another PM stated, "...I believe that when collocated matrix workers enter the office, they become part of the team and are willing to put out as much effort as core folks are." (PM, 1996) Based on these comments, PMs have found that by collocating matrix employees, the loyalty weaknesses identified earlier become much less intrusive.

While collocation is certainly one way which PMs have used to maximize matrix worker efficiency and gain loyalty, how do we address the problems associated with non-collocation? For instance, how do PMs know whether they are getting their money's

worth with from their non-collocated personnel? As one PM stated, "...I never know whether I am truly getting my money's worth from this person or whether he is just providing me enough work to keep me from getting on his back." (PM, 1996) According to one PM, the best way to reduce the effects of this situation is through a review process. In effect, "...the way to assist in the process of ensuring you are getting what you are paying for is to have quarterly review sessions and reports where the functional office must report how the full-time support personnel account for their hours." (PM/MSC manager, 1996) These reviews force the functional office to account for the actions of their support personnel. Unfortunately, while these reviews allow the PM to gain an understanding of what was accomplished over the quarter, it does not provide a full accounting for the expenditure of funding. According to one PM, "...this represents a major flaw in the way we do business, in terms of accounting on how time and resources are spent." (PM, 1996) Until program offices and MSCs can develop an answer to this dilemma, we will continue to condone a flaw "...which would never be accepted in our personal life or in commercial industry." (PM/MSC manager, 1996)

According to a recent Army Headquarters PMO Review Team investigation of the Army's weapon systems PEOs, business planning is already helping to maximize the value of resources expended in the matrix support arena. The team's report stated that PEO aviation has been in the forefront of this effort with the development of a model and supporting automated system designed to properly forecast and identify required resources, define matrix support requirements, and document the information for the planning, programming, budgeting, and execution of system needs. Unfortunately, the report

concedes that this model is confined to the short term, leaving a long term solution to the standardization of PEO structures throughout the Army. The standardization of PEO structures is designed to significantly enhance the MSC's ability to provide adequate matrix support to the PEO community. In theory, this solution is designed to stabilize required skill mixes for matrix support personnel, allowing MSCs to more efficiently forecast required resources. While standardization provides one possible answer, it is a solution with many opponents. (PMs, 1996) This opposition is led by PMs and PEOs who believe that no two projects are alike. By standardizing PM offices within PEOs, the loss in flexibility will negate any positive aspects of standardization (PM/MSC manager, 1996). While this issue is certainly one which will either help or hurt matrix support in the future, it remains undecided to date.

2. Customer Focus and the Effect of Teaming

One of the greatest innovations designed to maximize the matrix structure involves the concepts of customer focus and teaming. As addressed earlier, major subordinate commands are responsible for providing personnel and technical support to PEOs within the Army. In the mid to late 1980's, both the MSCs and PEOs had enough funding to pursue their individual interests without having to rely heavily upon each other for survival. With the shrinking of the defense budget and subsequent reductions in both military and civilian personnel, this era of independence came to an end. In order for MSCs to survive today, they must receive and fulfill support requests demanded by PMs and PEOs. While this situation represents a change from the past, MSCs which are

successful at providing the required support are able to maintain greater levels of employees; all else remaining equal.

The ability to not only provide support, but concurrently maintain a customer focus, is the difference between a matrix structure which merely works and a matrix structure which works effectively. The Army Materiel Command (AMC) took the lead in developing a way for PMs and PEOs to have a voice regarding how well they were supported. With the implementation of Quarterly Evaluation Reports (QER), PMs and PEOs now rate divisions within each MSC. These ratings are passed to the AMC commander via each MSC commander. In this way, both the AMC commander and his various MSC managers are able to evaluate the support they provide based upon PM and PEO input. Has this type of evaluation been effective? The overwhelming answer to this question has been yes. As one PM stated, "...divisions within MSCs have immediately responded to poor ratings by putting in inquiries as to why they received what they did." (PM, 1996) Still another PM stated, "...the labs and organizations (MSCs) send out surveys which they take very seriously...if there is a low rating, they immediately come to the office and ask us what they can do better." (PM, 1996) The end result of the QER system is summarized best by one particular PM who stated, "...the overall result of this has been an increasingly more customer-oriented functional organization which is more responsive to the PM office because they know that the input is being fed directly to the commanding general." (PM, 1996)

While the QER system has assisted in instilling a more customer-oriented mindset on behalf of many MSCs, it is not the only reason. Many MSCs did not need to be

involved in the QER system in order to see the writing on the wall. The message was delivered instead by a reduction in functional budgets and personnel. As one PM stated, "...many of matrix's problems are going away with the customer satisfaction initiative by MSCs and the current downsizing initiatives." (PM, 1996) With the shrinking budgets, MSCs have realized that they cannot maintain their positions without the financial support provided to them by the PEOs. As one PM stated, "...many organizations which provide matrix personnel support have realized that their bread and butter lies with the quality of support provided to the project offices...failure to meet the requirements set out by the PM results in reduced incomes, and a reduced labor force." (PM, 1996) Thus, the effect of the shrinking budget has made MSCs realize that supporting the PM is now a top priority instead of a nuisance. In the words of one official, "...customer focus is one of our strong points, we have learned that we have to pay attention to the customer and remember that he is a paying customer." (MSC manager, 1996) If the MSCs do not see the writing on the wall, the result will be clear. As one MSC manager stated, "...if we are not giving that customer a quality product in a timely fashion, then he has the opportunity to go elsewhere to buy it (support contractor or other MSC)." (MSC manager, 1996)

Closely related to the concept of customer focus is the spirit of teaming. Teaming consists of a dedication or reliance on the inputs and outputs of two entities which are designed to promote the overall good of both. The current environment of teaming and collaboration on behalf of many the PMs and MSCs have assisted in adding efficiency to the matrix structure. As one PM stated, "it is not the PM and the functional, it is both working this thing together as a team." (PM, 1996) A MSC manager put it just as well

by stating. "...you must work at it (matrix structure) to make it work...it has got to be a mutual and agreed upon thing between the PM and the MSC in order to exercise it to everyone's best mutual benefit." (MSC manager, 1996) Without the ability for each side to recognize his position and duties within the matrix configuration, neither side will succeed. In other words, matrix structure is only as strong as its weakest link. For matrix to be effective, the relationships between the functional and project offices must be based upon open and trusting collaboration instead of animosity. In effect, the supporting and supported entities work together in order to achieve outcomes that neither could realize by working independently.

3. The Rating Game

One policy which PMs universally agree must be enforced involves the performance evaluation guidance as outlined in AR 70-1. As stated in Chapter II, the PEO or PM must have the ability to influence the performance evaluations of his matrix support personnel. The regulation specifically calls for the PM or PEO to be the reviewing official for civilian performance appraisals. However, this policy is yet to be universally implemented. The overall effect of not allowing the PM to be involved in the rating chain is the inability of the PM to influence worker performance when worker loyalty and dedication is clearly oriented toward the worker's functional base. When this situation occurs, the program office's effectiveness and efficiency are likely to suffer as decisions made by the PM can be "blackballed" by matrix workers who are not subject to any form of retribution. As one PM stated, "...if the PM is not in the rating scheme,

he does not have control over what is happening in the organization in terms of his personnel." (PM, 1996)

While the guidance set out in AR 70-1 has not been implemented by several PEOs, others have worked out arrangements with their supporting MSCs, allowing them to be involved with matrix personnel evaluations. Under some situations, MSCs have worked out rating arrangements under the customer focus initiatives discussed earlier. In effect, the MSCs negotiate personnel evaluation schemes with PMs as part of the annual MOA. The end result of this initiative includes satisfied PMs who feel they now have a say in their employees' careers. While success stories do exist, the failure of PEOs and MSCs to universally implement the guidance dictated in AR 70-1 has led to impediments of the initiatives designed to enhance the overall performance of the matrix structure.

4. Leadership

One way in which PMs attempt to optimize or improve the matrix structure is through quality leadership. In this context, leadership is differentiated into two different categories: leadership and its role in the development of binding relationships between MSC managers and PEOs; and leadership combined with interpersonal skills which PMs must implement at the program level. The first category, leadership's role in the development of binding relationships between MSC managers and PEOs, is closely related to the customer focus initiatives instituted by many MSCs. However, the role in which leadership plays in this relationship deserves further analysis. According to many of the PMs interviewed, the relationship between individual PMs and the supporting commands is critical with respect to the quality of support provided. Where should this relationship

begin? According to one PM, "...the relationship can, and should be set at the PEO level, and the quality of support provided is due largely to the relationship between the supported and supporting commands." (PM, 1996) This belief was echoed during the Headquarters PMO Review Team's findings as well. The team stated, "...it is our position that the matrix support problems observed in the PEO/PM structure can only be resolved through a cooperative effort of both the Army's PEO and materiel command structure leadership." (HQ PMO Review Team Memorandum, 1993) The relationship established between the MSC manager and the supported PEO is often driven by human character, both good and bad. PEOs and MSC managers who are able to take advantage of the good, while eliminating the bad, exercise the leadership necessary to make matrix work. As one PM stated, "...personalities are what makes matrix work, not the organization, and the fact that the MICOM commander has the same goals as the PEO makes it easier and better." (PM, 1996)

While professional relationships and leadership dictate the overall working environment within a PEO and its supporting MSC, leadership and interpersonal skills implemented at the program level are important as well. When asked to respond to why matrix structure works in program offices, one PM stated, "...leadership demonstrated by the PM and supervisors along with interpersonal skills gets the response necessary to get things done in project offices these days." (PM, 1996) Another PM added to this inference by stating:

> Managing the program office has leadership associated with it, and involves erasing the distinction between core and collocated matrix workers so that people do not think about it...all team building and total quality management (TQM) should be done so that there is no visible difference and you have to stop and

> think who is core and who is matrix. This creates environments of loyalty and this makes a big difference in the way people think about themselves and the program. (PM, 1996)

Beyond any other answer given on how to best optimize the matrix structure within project offices, PMs overwhelmingly chose the proper implementation of leadership. While this answer can never serve as a cure-all for each of the weaknesses found within the matrix structure, it can provide solutions designed to enhance worker loyalty, commitment, and the sense of belonging. As one PM stated, "...we have good leadership and interpersonal skills which can make any organization work if we want to make it happen." (PM, 1996)

While one overwhelming program manager, MSC manager, and Headquarters PMO Review Team answer for improving matrix structure involves implementation of quality leadership, personnel relationships, and interpersonal skills, the Headquarters PMO Review Team introduced one additional facet: increased education. In their findings, the team recommended that future plans include education and training in human resource management to include training on how to achieve the proper mix of the work force (military, civilian, support contractor, core, collocated matrix, non-collocated matrix) and their required skills. In the team's opinion, this education and training will assist PMs in becoming more proactive in acquiring personnel in a timely manner and replacing personnel when their skills are no longer required for the project. Regardless of the hierarchial level addressed under the leadership solution, one aspect remains clear: the implementation of quality leadership, interpersonal skills, and professional relationships designed to enhance the matrix structure's performance are absolutely essential. As one

PM stated, "People can make matrix work, and it is through leadership, interpersonal skills,and feedback with open communications between functional and project commands that yields success." (PM, 1996) While many possible solutions designed to optimize the structure may be tested in the near future (and either adopted or discarded), the implementation of quality leadership, interpersonal skills, and the importance of personal relationships will never become passe.

5. A Word Regarding Integrated Product Teams

The introduction of Integrated Product Teams (IPT) at the program level offers some interesting aspects with respect to matrix structure. IPTs at the program level are designed to support the PM in the development of strategies for contracting, cost estimation, evaluation of alternatives, logistics management or other important concerns. (Institutionalizing IPTs) In effect, IPTs are comprised of experts from each functional area (design engineers, logisticians, production engineers, users, testers, etc.) who are empowered by their position to review, make, and implement decisions regarding a particular system or subsystem within a program. The desired goal of IPTs is a systematic integration and concurrent application of all necessary disciplines throughout a system's life cycle to produce an effective and efficient product or process that satisfies the customer's needs. (Wagner and White, 1995, p. 34)

The acceptance and use of IPTs may provide many advantages to project offices while eliminating some of the weaknesses of the matrix structure. While this statement is bold, it may hold true. The advantages offered by IPTs include team member loyalty, empowerment, and a change in perspective (from oversight and condemnation to

participator and doer). At least one of the advantages offered by IPTs should sound familiar as it was one of the biggest weaknesses which PMs identified regarding the matrix structure. As one PM stated, "...the reason we want to get the IPT under the PM is, at least in part, a matter of loyalty...so that the people working for the team realize that the reason they come to work each day is for the betterment of the product." (PM, 1996) Thus, the ability of IPTs to create environments of cohesion and mutual benefit enables personnel (core and matrix alike) to become conduits, rather than obstacles, to progress.

The ideas regarding teaming and IPTs have just started to gain support within Army project offices. According to some of the PMs interviewed, IPTs of the future should consist of core and matrix personnel who work directly with contractor personnel in the contractor's office. In this way, the role of core and matrix personnel will change from oversight to one of decision making and participation within the contractor's development processes.

While IPTs may be the trend of the future, they must still find a way to overcome the cultural hurdles which face them today. The first of these hurdles is the concept of empowerment. The nature of IPTs dictate that individual members are empowered to make decisions without necessarily obtaining approval from the PM. This cultural "leap of faith" is likely to take time, as the entire establishment must have confidence in the level of competency and decision-making capability of each empowered worker. This is because the decisions made by individual members of the team will affect the entire end product. (PM/MSC manager, 1996)

The next cultural hurdle facing IPTs involves some current PM philosophies regarding the timing and duration of their use. While many PMs have began to incorporate the ideas of the IPT type structure within their offices, others have chosen to maintain their offices in the status quo, establishing IPTs only when necessary. As one PM stated, "IPTs should be used for specific issue-driven, issue-resolution decisions...where they are issue-driven, hard-hitting, and short-duration to make decisions, they are great." (PM, 1996)

The final IPT cultural change which must be addressed involves the personnel mix. Since IPTs consist of members who are empowered with decision-making authority, members of the team (both core and matrix) will likely be comprised of higher grade levels. This situation is likely to create a need for changes in the grade level manning requirements of both core and matrix personnel within program offices. (PM/MSC manager, 1996) What will the impact be? At this point, the question is hard to answer because pure IPTs are only embryonic at this point. However, the question remains, and must be addressed in the future if pure and empowered IPTs are to provide a more efficient and effective structure within Army project offices.

F. CHAPTER SUMMARY

The purpose of this chapter was to introduce the strengths the weaknesses of the matrix structure which PMs have observed in Army acquisition project offices. In addition, the chapter also discussed some of the organizational variants and methods which PMs feel can be used to optimize the structure. From this discussion, PMs and MSC managers identified two broad categories of strengths offered by the matrix

structure: the attributes of flexibility and increased access to knowledge. While flexibility was unanimously offered as the greatest benefit of the matrix structure, increased access to knowledge proved to be more beneficial to smaller project and product offices.

While cognizant of its strengths, PMs and MSC managers also acknowledged the weaknesses inherent to the matrix structure. These included both worker loyalty and worker selectivity. The worker loyalty weakness included the aspects of matrix employee allegiance, and the performance evaluations and award system. The worker selectivity weakness discussed the inability of the PM to control the selection process of matrix employees who worked for him, as well as his inability to control both the timing and rationale behind personnel replacements. In addition, this section introduced the difficulties encountered by the PM in obtaining matrix support from MSCs other than the program's primary MSC, as well as the growing concern over the lack of technically competent personnel.

The chapter concluded with a discussion of how PMs have attempted to optimize the current matrix structure. This discussion included the aspects and importance of collocation, involvement of the PM in performance evaluations and rewarding of matrix workers, the importance of leadership and interpersonal relationships, and finally, the importance of MSCs developing a customer focus. The final issue addressed in this chapter was the concept of IPTs. This discussion was introduced in order to address one possible organizational variant which may enable the matrix structure to become more effective and efficient in the future. While the concept of IPTs may enhance the

performance of project offices in the future, several issues regarding pay grades and competency levels must be addressed before the concept is allowed to evolve from the experimental stage into a universally-employed organizational form.

V. SUMMARY, RECOMMENDATIONS, AND CONCLUSION

A. SUMMARY

The information obtained during the course of this thesis suggests that matrix structure can operate within Army acquisition program offices. While the structure has many weaknesses, PMs and MSC managers have found ways to optimize the organizational form into one which operates effectively. By implementing the suggestions made by PMs and MSC managers concerning ways to improve the structure, matrix may eventually evolve into an organizational form which can work effectively and efficiently in today's environment of shrinking budgets and streamlined costs. While innovative thinking and proactive leadership at the PM and MSC manager levels have spearheaded the effort to improve the level and quality of support provided to program offices, senior leadership within the Army must be willing to join the march. Failure to obtain senior level support and commitment to improve the structure will only result in wide variances in effectiveness between different PEOs and MSCs throughout the Army (a condition which, not surprisingly, exists today).

What is the best policy for implementing matrix? The results of this thesis show that it is not just one aspect. Instead, it is a combination of measures which should be used concurrently in order to maximize the structure's effectiveness. In the end, the best answer for improving matrix may be "...to completely turn over functional personnel entirely to the program office when they are moved to the program." (PM/MSC manager, 1996) In this way, PMs will be in a better position to take advantage of matrix's strengths while minimizing and/or eliminating its weaknesses.

B. CONCLUSIONS ON RESEARCH QUESTIONS

1. Primary Research Question

What are the possible methods or organizational variants which can be used to improve or optimize the matrix organizational structure as an effective form of management within Army acquisition program management offices?

Based on the information obtained from PMs and MSC managers, the answer to this question involves a combination of four methods and the possible implementation of one organizational variant. The first method involves the issue of collocation. Each of the PMs interviewed believed that there is a significant difference between the level of support received from a collocated matrix worker verses that from a non-collocated one. According to many of the PMs, collocating matrix workers within the program office assists in resolving the loyalty weakness inherent to the structure. This is because collocated workers identify with the program office over time, eventually adopting a project-oriented identity. This "sense of belonging" is extremely important with respect to worker loyalty.

The second method involves the concepts of customer focus and teaming. With the shrinking of the defense budget and subsequent reductions in both military and civilian personnel, PEOs and MSCs have become more and more interdependent. Major subordinate commands have realized that in order to survive, they must receive and fulfill support requests demanded by PMs and PEOs. Additionally, MSCs now implement Quarterly Evaluation Reports in an attempt to promote customer relations between themselves and the PEOs they support. Closely related to the customer focus concept is the spirit of teaming. Major subordinate commands and PMs have realized that their

relationships must be built on trust and collaboration to survive. The history of animosity which frequently existed between the two must remain in the past in order for each to remain effective in an era of shrinking budgets.

The third method which PMs identified as a way to improve matrix structure involves worker performance evaluations. While policy dictates that PMs are to have rater or senior rater input into matrix worker performance evaluations, many as yet do not. The effect of not allowing the PM to be involved in the rating chain results in his inability to completely influence worker performance. The failure of PEOs and MSCs to universally implement the guidance dictated by AR 70-1 has impeded the initiatives designed to enhance the overall performance of the matrix structure.

The fourth method PMs use to optimize matrix structure involves the role of leadership. The relationship between MSC managers and PEOs involves leadership issues which must be addressed. A quality, professional, and self-respecting relationship between individual PMs and the supporting commands is critical to the quality of support provided. If the matrix structure is to become increasingly efficient, it will require the cooperative effort of both the PEO/PM and MSC leadership. While the professional relationship between PMs and MSC managers is important, the role leadership plays in optimizing matrix must permeate many levels. As stated in Chapter IV, quality leadership, personnel relationships, and interpersonal skills are essential elements which PMs must possess in order to optimize a structure in which worker loyalty and commitment are critical issues. While leadership will never be a cure-all for every

weakness found within the matrix structure, it can provide solutions designed to enhance worker loyalty, commitment, and sense of belonging.

The organizational variant which PMs cited as offering potential with respect to optimizing the matrix structure is the use of program level IPTs. The advantages offered by these IPTs include team member loyalty, empowerment, and a change in perspective from oversight and condemnation to participator and doer. While the use of IPTs may eliminate the problems associated with loyalty (by instead creating environments of cohesion and mutual benefit), it faces many cultural hurdles. If these hurdles can be addressed, the use IPTs as a matrix variant may offer a more efficient and effective structure for Army program offices.

2. Subsidiary Research Questions

a. What is matrix structure, and when is it used?

Matrix structure is an organizational form in which individual workers belong to one manager (department head) while working as part of a concerted effort (defined as a project) under a different manager (project manager). Matrix employees are able to work as part of a program for a period of time, returning to their functional base and duties when the program no longer requires their support. In turn, these employees may remain with the functional base for a long period of time, or be reassigned to other programs which require their expertise.

According to Davis and Lawrence, matrix structure is normally used by organizations which find themselves in environments of outside pressure for dual focus, pressure for high information-processing capacity, and pressure for shared resources.

While arguments can be made with respect to the primary reason why the Army adopted the matrix structure, the pressure for shared resources under conditions of shrinking budgets and streamlined costs may top the list.

b. What are the published benefits and weaknesses of matrix structures?

The published strengths of the matrix structure include the following: ability to manage dual environmental demands, flexible use of specialized personnel, adaptability to external change, and personal skills development. While the ability to manage dual environmental demands includes the published intent of empowering decision makers at lower levels than in conventional organizations, this strength has yet to be universally realized in Army program offices. The next matrix strength, flexible use of personnel, consists of the ability to assign and reassign specialists in order to maximize both their potential, as well as the needs of the projects they represent. Closely related to the flexibility strength, is matrix's adaptability to external change. This strength is important as it allows new activities to be incorporated or cancelled without a drastic change to the overall matrix structure. The last published matrix strength is personal skills development. In theory, matrix structure allows employees to become more energetic, self-starting, and team players. However, each of these traits must be developed through proper training on the workings, environment, and stresses associated with the matrix structure.

Matrix structure has weaknesses as well. The published weaknesses include authority ambiguity, management conflict/power struggles, worker conflict and confusion, communication, and anarchy. Authority ambiguity occurs when there are no clear lines

of authority regarding decision-making responsibilities between project and functional managers. Workers can often become confused as to which manager's decision is final, and which is not. Management conflict (and ensuing power struggles) is common to matrix organizations which do not establish clear lines of authority as well. Under this weakness, functional and project managers each attempt to gain control, creating "turf war" conflicts throughout the organization. Worker conflict and confusion occurs when collocated matrix workers believe that regardless of the quality of their work, other workers involved in performing equivalent tasks at their functional base's home station will be given preferable treatment on performance evaluations and other systemic rewards. This weakness is common in matrix organizations which do not allow the project office to take part in matrix worker performance evaluations. The communication weakness inherent to matrix structure has several causes. These include: the continual change of personnel, the increased number of managerial layers, and the interdependencies of a structure which requires increased communication. While advances in communications technology offers several solutions to this weakness, it is by no means a cure-all. Instead, technological advances must occur in conjunction with increases in the amount of training provided for managers and technical personnel alike. The final published matrix weakness is anarchy. Anarchy occurs when employees are reluctant to change as the organization adopts the matrix structure. This fear of the "unknown" often results in direct worker sabotage of the structure.

c. What is DoD's posture on the use of matrix structures?

The DoD uses the matrix structure in order to take advantage of its ability to operate effectively under conditions of shrinking budgets, streamlined costs, and increasing technical specialization. Army Regulation 70-1 provides a distinct breakdown of both the supported (project office) and supporting (Army Materiel Command) commands. According to AR 70-1, PEOs and program managers are given the authority and resources to manage program cost, schedule, and performance. Meanwhile, the regulation states that the Army Materiel Command, and its subordinate MSCs, are to provide the support needed by the PEOs in such a way as to ensure program success. This support consists of both material and personnel.

While AR 70-1 provides some insight into the Army's use of the matrix structure, PEOs and PMs receive their guidance concerning personnel requirements through the Assistant Secretary of the Army for Research, Development, and Acquisition's (ASARDA) TDA. The TDA dictates how many core personnel each program office is authorized to employ. Any other support that a PM requires is then filled by the office's supporting MSC. While the general guidance is the same throughout the entire Army, variability between PEOs, and program offices within PEOs, remains. Although standardization within all PEOs is an issue under current debate by senior Army leadership, many PMs have commented that PEOs should retain the right to direct the development, acquisition, modification, and fielding of assigned programs.

d. What are the actual benefits and weaknesses of using matrix structure in Army acquisition program offices?

The two matrix structure benefits which PMs cited were both flexibility and an increased access to knowledge. Flexibility is universally accepted as the greatest matrix strength. The ability to quickly add or delete personnel from the program is an attribute which is greatly appreciated by the PMs. Program managers cited this benefit as an essential one, as it is used extensively when a program moves through a milestone decision into its next phase. The increased access to knowledge benefit involves the ability of a matrix worker to draw upon large amounts of experience and knowledge from his peers who remain at the functional base. This attribute allows individuals with limited expertise to be able to draw on experience from within their functional area to help them surmount the hurdles which they do not have the necessary expertise to conquer themselves. While this strength allows smaller project offices to have increased access to talent that they would not normally be able to obtain, it is not as critical to larger programs.

Matrix weaknesses were summarized under two broad categories: worker loyalty, and worker selectivity. Worker loyalty involved the facets of motivation and allegiance. This weakness involved discussion on the loyalty differences between collocated and non-collocated matrix workers. Similarly, the inability of many PMs to be involved in matrix worker performance evaluations comprises another facet under this weakness. The worker selectivity weakness is summarized as the inability of the PM to have complete control in determining which matrix worker he is provided. Facets under this weakness include barriers in accessing matrix workers from other MSCs, MSC replacement of matrix

workers without proper cause, and a growing lack of competent Government technical personnel.

C. RECOMMENDATIONS

The following recommendations are offered by this researcher and are based upon both the researcher's assessment of the literature and the interviews conducted.

Recommendation #1: If the matrix structure is to become more effective and efficient within Army program offices, then steps must be taken to address the comments of the PMs interviewed during the course of this thesis. Several of the methods identified by the PMs are capable of being adopted immediately. These include involvement of the PM in the performance evaluation and reward structure of collocated, and at times, non-collocated matrix workers. While AR 70-1 and Army Acquisition Executive Policy Memorandum 91-4 require this involvement, PMs within many PEOs still lack this authority. Until changes are made, PMs within many PEOs will continue lack total control over what is happening with the personnel in their organizations.

The next method which must be incorporated is a complete saturation of the customer focus initiatives introduced by some MSCs. Until each MSC understands who their customers are, and how to best support them, program manager conflicts and dissatisfactions with the matrix structure will continue. It is time to introduce the aspects of interdependence and teaming, instead of continuing with the philosophies of independence and isolationism.

The leadership and innovation demonstrated by PMs in their efforts to enhance the matrix structure cannot go without recognition. Leadership's role in the development of

binding relationships between MSC managers and PEOs deserves further analysis and discussion. If the matrix structure is to become more effective and efficient, then relationships supporting the aspects of teaming and mutual respect must be initiated at the highest levels within the Army's PEO and materiel command structures. Binding relationships at this level will only flow downward, further cultivating environments of leadership commitment and worker loyalty.

While collocation has been cited as one possible way to build matrix worker loyalty and commitment, it is an infeasible solution for PMs who lack the office space or do not require the use of certain talents on a continual basis. However, if the PM has a choice as to whether to collocate his full time matrix support, the answer provided by the interviewed PMs is clear: yes, because it can only help encourage worker loyalty!

Recommendation #2: Senior leadership within the Army must continue to support further experiments with the use of IPTs at the program level. Many IPTs are beginning to show signs of promise which must be further analyzed. An example of this is evident within the Enhanced Fiber Optic Guided Missile (EFOGM) project, where the program office's matrix and core personnel are working side-by-side with the contractor, in the contractor's own plant. Information obtained during the course of this project may revolutionize the way program offices operate in the future. As stated earlier, if matrix is to become more efficient and effective, worker loyalty and commitment are essential. The implementation of IPTs into program offices helps ensure that these two traits have a better chance of becoming inherent.

While IPTs show promise, several issues must be addressed in the future if the attributes of worker empowerment and decision-making authority are to be fully implemented. These issues include both cultural changes and grade level manning requirements. While it is clear that neither of these issues has an easy answer, program test-beds and experiments must be supported in order to further analyze the advantages offered by this organizational variant.

D. RECOMMENDATIONS FOR FURTHER RESEARCH

The following are two recommendations for further research regarding matrix structure in Army program offices.

1. An analysis of the differences in the number and type of matrix verses core personnel in a program office represents one challenge. To support this, a case study could be conducted which would compare the Armored Gun System's solution (a core made up of technical personnel) with another program which possesses a core of administrative personnel and relies on matrix support to provide technical expertise to the program.

2. A case study of the experimental use of IPTs in the EFOGM program offers another challenge. This case-study oriented thesis would document the use of program level IPTs (consisting of both core and matrix personnel) who are working side-by-side with Rayethon Corporation (in the contractor's own plant) to develop the EFOGM for the Army. This experimental use of an IPT is breaking new ground in Huntsville, Alabama, and may offer some answers to the questions regarding the widespread use of IPTs (cultural changes and grade level manning requirements).

E. CONCLUSION

The Army adopted the matrix structure in an attempt to provide its program offices with increased integration and coordination of specialties under conditions of shrinking budgets and streamlined costs. This change in organizational structure and culture has led to the successful implementation of numerous state-of-the-art technologies in weapon

systems. While few will argue with the matrix structure's effectiveness toward enabling these systems to support the Army's many missions, many question the structure's efficiency. This is due, in part, to the many matrix weaknesses which have surfaced over time. Until solutions to these weaknesses are found, program managers throughout the Army will continue to face obstacles which impede, rather than facilitate, effective program management.

The intent of this thesis was to identify and discuss possible solutions to the weaknesses inherent to the matrix structure. Input regarding these solutions was obtained from the individuals who must work with the system daily: the program and MSC managers. Their responses have provided this research with some interesting conclusions. If the matrix structure is to become more efficient in the future, the ideas offered in this thesis must be analyzed. After all, who knows more about the system and structure than those who have been given the responsibility to implement it?

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